January 21, 1957 50 Cents

AVIATION WEEK

A McGRAW-HILL PUBLICATION

SOURCE UNKNOWN

C-123 May Supply Navy Task Forces

•

Engineer Shortage Doubted in Report

Douglas C-124 Globemaster

Heart for a new Helicopter

. . . an achievement in precision and performance

The skill and craftsmanship of FOOTE BROS. in the manufacture of gears, actuators and assemblies has contributed to this achievement

Main rotor transmission for Sikorsky S-58 Helicopter

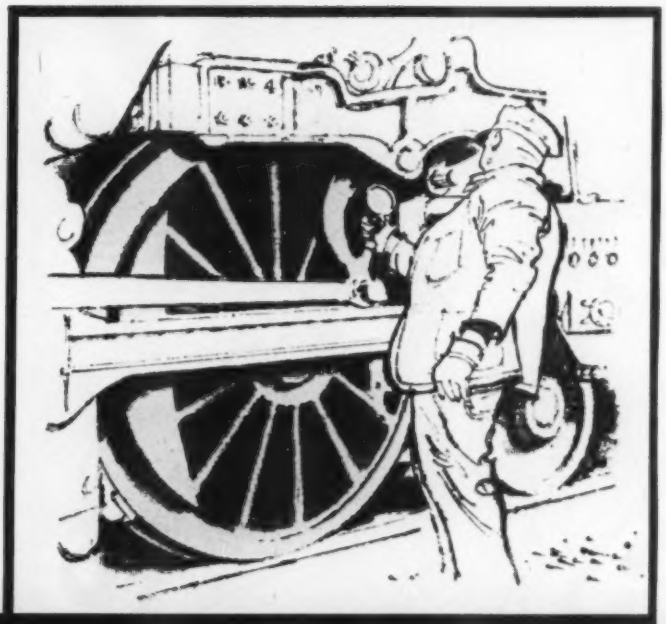
This trad… stands for th… industrial gearing made!

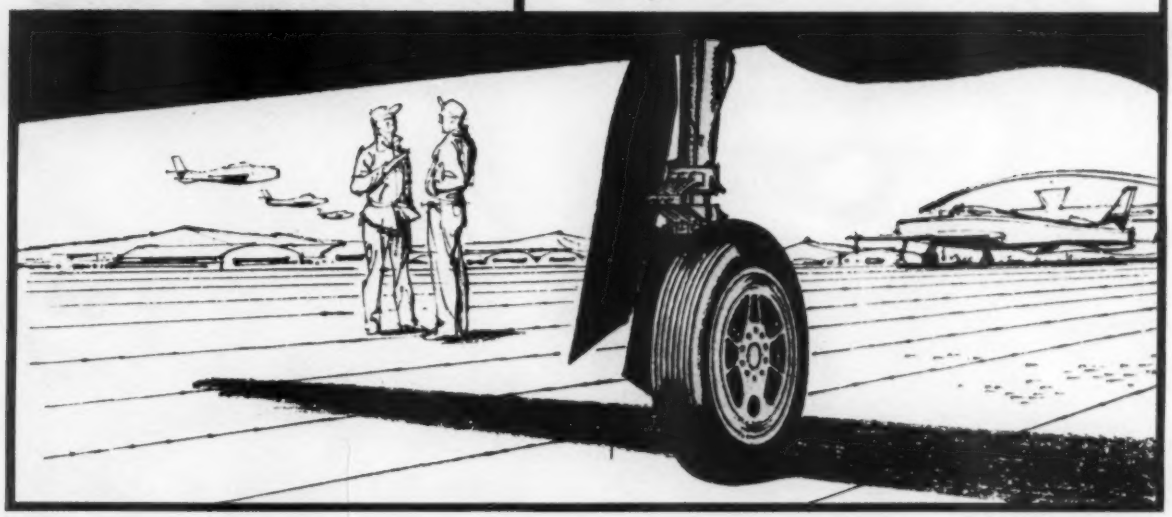
Duti-Rated

FOOTE BROS.

Better Power …

Which wheel is the strongest?





Above is the drive wheel of a giant locomotive.

The other is an airplane wheel of a modern-day jet fighter.

Which wheel is the strongest?

You air-minded ones are right.

It's the forged light-alloy wheel designed and produced by Goodyear Aviation Products: *pound for pound it can roll a record capacity.*

Forged wheels of magnesium or aluminum typify weight-saving developments—without sacrifice of performance—made by Goodyear Aviation Products for the aeronautics industry.

This extracting of maximum performance from minimum weight can be laid directly to engineering skills—and the vast research and development facilities—of the organization which produces tires, wheels and brakes for more aircraft than any other manufacturer.

In the case of aluminum or magnesium wheels, it called for detailed study which produced forgings of uniform quality and grain flow—and the elimination of "gingerbread" castings.

Goodyear forged light-alloy wheels are operational on more aircraft of more types, both military and commercial, and in more sizes and types, than any other kind.

In the case of a ship you now have upon the boards—this strength-to-weight engineering may well extend the range, the altitude, the firepower of your project. Call in a Goodyear man—get the facts, and the help of this kind of thinking! Write: Goodyear, Aviation Products Division, Akron 16, Ohio, or Los Angeles 54, California.

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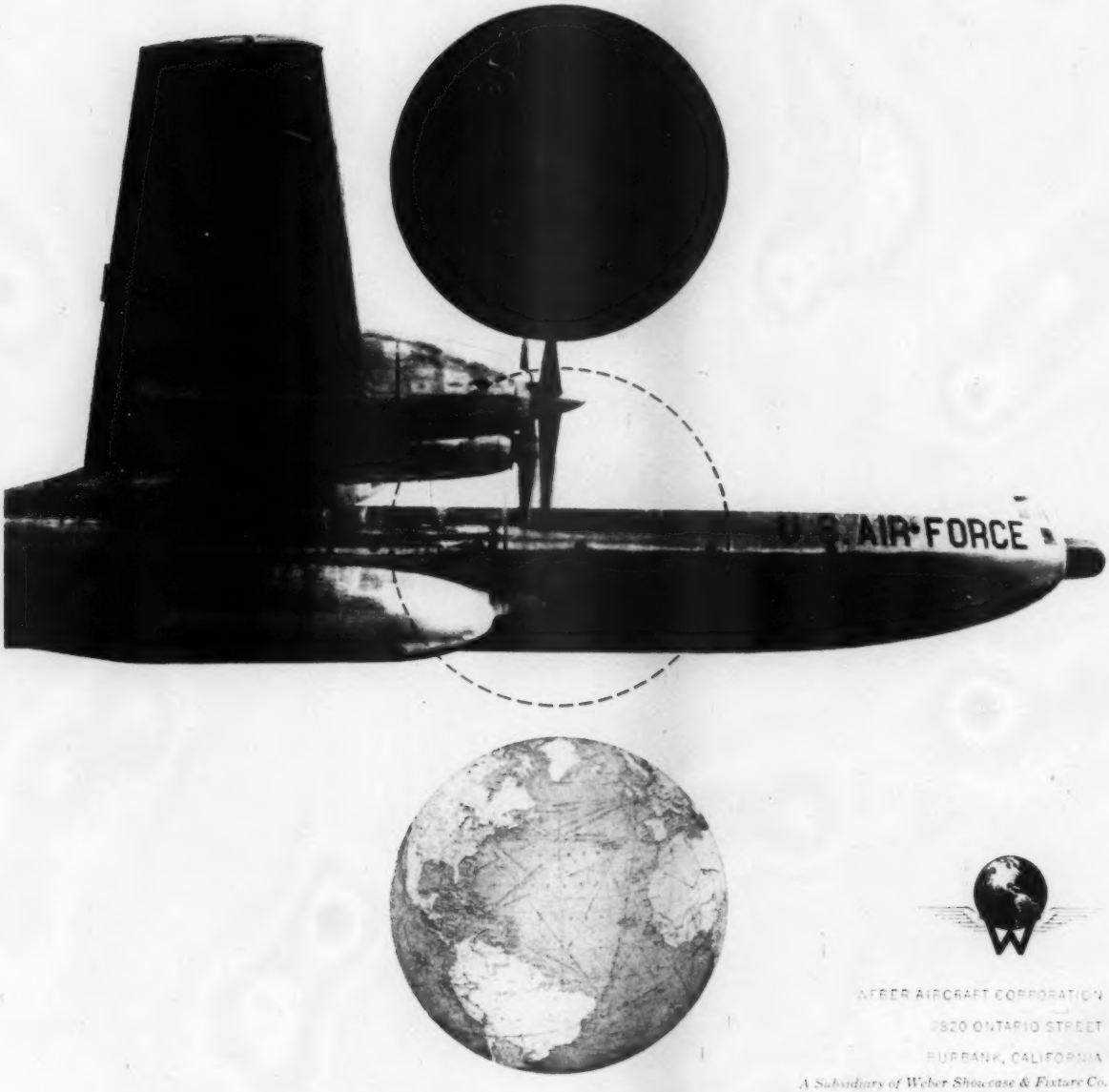
Where Research and Development Work to Advance America's Global Position in the Race for Air Power

The Douglas C-133A

is a giant among cargo carriers.

Navigator seats for these behemoths

are designed and built by Weber.



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GROUND HANDLING EQUIPMENT
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AIRCRAFT SUB-ASSEMBLIES

AVIATION CALENDAR

Jan. 27-28—American Society for Metals, Albuquerque and Los Alamos Chapters, "Heat Tolerant Metals for Aerodynamic Applications," Albuquerque, N. M.

Jan. 28-31—5th Plant Maintenance & Engineering Conference, Public Auditorium, Cleveland, Ohio.

Jan. 28-31—25th Annual Meeting, Institute of the Aeronautical Sciences, Sheraton-Astor Hotel, New York, N. Y. Honors Night Dinner, Jan. 28.

Jan. 30—Annual Meeting, Convertible Aircraft Pioneers, Engineers Club, New York.

Jan. 31—Sixth Annual Instrument Short Course, Los Angeles Harbor Junior College, Wilmington, Calif. Additional course will be held Feb. 1.

Jan. 31-Feb. 1—Conference on Digital Computing in the Aircraft Industry, sponsored by New York University and International Business Machines Corp., NYU Bronx Campus, New York, N. Y.

Jan. 31-Feb. 2—Conference on Adhesive-Bonded Structures, Society of Aircraft Materials and Process Engineers, Institute of the Aeronautical Sciences Building, Los Angeles, Calif.

Feb. 4-8—Course on X-ray diffraction, sponsored by North American Phillips Co., 750 S. Fulton Ave., Mt. Vernon, N. Y.

Feb. 7—Operations Research Symposium, University Museum Lecture Hall, University of Pennsylvania, Philadelphia, Pa.

Feb. 7—Annual Mid-Winter Symposium of the New York Section, Instrument Society of America, Garden City Hotel, Long Island, N. Y.

Feb. 14-15—1957 Transistor and Solid State Circuits Conference, University of Pennsylvania, Philadelphia, Pa.

Feb. 16-19—6th Annual Trade Show & Convention, Institute of Surplus Dealers, New York Trade Show Bldg., New York.

Feb. 26-28—Western Joint Computer Conference, sponsored by IRE, AIEE and ACM, Hotel Statler, Los Angeles, Calif.

Mar. 7-9—National Conference on Aviation Education, Hotel Mayflower, Washington, D. C.

Mar. 11-15—1957 Atomic Exposition, including Nuclear Engineering & Science

(Continued on page 6)

AVIATION WEEK • JANUARY 21, 1957
Vol. 66, No. 3

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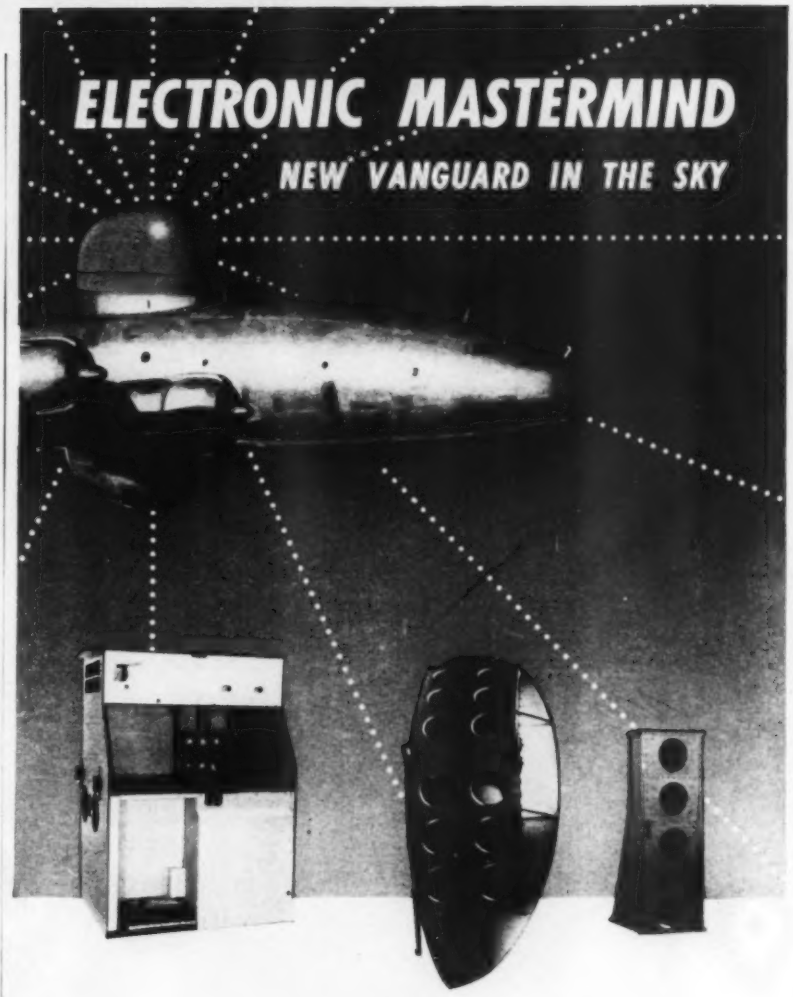

THESE RADAR COMPONENTS *fabricated by Lavelle help make advanced concepts in the use of electronics a working reality. Lockheed's unique picket plane is such—a complete airborne radar search and control center for both offensive and defensive operations. Images fed by the "piggy-back" radar to the control center radarscope give altitudes of all aircraft within radar range.*

Radar Reflector and Reflector Support for the plane's complex height finding system were designed and produced by Lavelle in close cooperation with Philco Corporation. Like the intricate Radar Console housing, also made by Lavelle for Philco, they are typical of the precision components fabricated by Lavelle for leading electronics, jet engine, and aircraft manufacturers.

A new brochure describes Lavelle's specialized fabricating facilities. Write for a copy without obligation.

Lavelle

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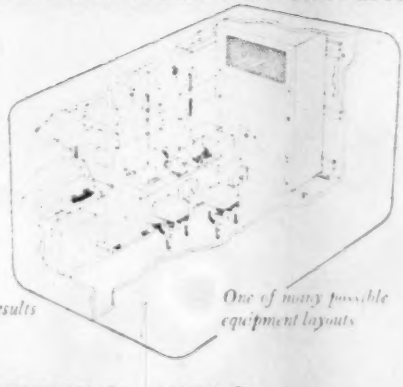

One of many possible equipment layouts

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AVIATION CALENDAR

(Continued from page 5)

Congress, 5th Atomic Energy in Industry Conference and 5th Hot Laboratories & Equipment Conference, Convention Hall, Philadelphia, Pa.

Mar. 14-15—Flight Propulsion Meeting, (Classified), sponsored by IAS, Hotel Carter, Cleveland, Ohio.

Mar. 18—Gas Turbine Power Conference, sponsored by American Society of Mechanical Engineers, Sheraton-Cadillac Hotel, Detroit, Mich.

Mar. 18-21—Pacific Coast Plastics Exposition, in conjunction with The Society for Plastics Industry National Conference, Shrine Exposition Hall, Los Angeles.

Mar. 18-21—National Convention, Institute of Radio Engineers, New York Coliseum and Hotel Waldorf-Astoria, New York.

Mar. 18-21—First Military Automation Exposition, New York Trade Show Building, 500 Eighth Ave., New York. For details write: Richard Rimbach Associates, 845 Ridge Ave., Pittsburgh 12, Pa.

Mar. 25-29—Western Metal Congress and Exposition, Ambassador Hotel and Pan-Pacific Auditorium, Los Angeles.

Mar. 27-29—Educational Colloquium on Radiation Effects on Materials, sponsored by Office of Naval Research and Glenn L. Martin Co., Johns Hopkins University, Baltimore, Md.

Apr. 2-5—National Aeronautic Meeting, Aeronautic Production Forum and Aircraft Engineering Display, sponsored by Society of Automotive Engineers, Hotel Commodore, New York.

Apr. 3-5—Spring Meeting, American Rocket Society, Sheraton Park Hotel, Washington, D. C.

Apr. 17-20—Eighth Annual Conclave, Arnold Air Society, including aviation equipment display, Hotel New Yorker, New York, N. Y.

Apr. 24-25—Second National Industrial Research Conference, sponsored by Armour Research Foundation, Conrad Hilton Hotel, Chicago, Ill.

Apr. 25-26—Annual Technical Meeting, Institute of Environmental Engineers, La Salle Hotel, Chicago, Ill.

May 1-3—Spring Meeting and Exhibit, Society for Experimental Stress Analysis, Hotel Statler, Boston, Mass.

May 6-8—28th Annual Meeting, Aero Medical Assn., Shirley Savoy Hotel, Denver, Colo.

May 8-11—13th Annual National Forum, American Helicopter Society, Sheraton Park Hotel, Washington, D. C.

May 24-June 2—22nd Paris Air Show, Society of French Aircraft Constructors, Le-Bourget Airport, Paris.

June 1-9—First Annual National Aviation Trade Show, Monmouth County (N. J.) Airport.

June 23-25—29th Annual Meeting, Aviation Distributors & Manufacturers Assn., The Broadmoor, Colorado Springs, Colo.

Sept. 1-6—Sixth International Aeronautical Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Folkstone and London, England.

Sept. 2-8—1957 Flying Display Society of British Aircraft Constructors, Farnborough, England.

The U.S.A.F.'s mighty interceptor, the Convair F-102A

This pilot may marvel at the powerful performance of his mount, but he values safety as well. And he *knows* he has both! In a moment or so he will also *know* that his landing gear is down and locked, ready to accept the shock of touchdown, because an Electro-Snap switch will tell him—*with authority.*

Electro-Snap is a part of the fine tradition of aircraft safety and reliability. Our responsibility is the design and precision manufacture of tough, reliable control and safety switches with *completely predictable performance.* THIS IS OUR ONLY BUSINESS! All our creative efforts go into this one activity...making better "standard" switches and engineering "special" switches for unique aircraft and industrial requirements.

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creates a supporting skyway to your desired touchdown point

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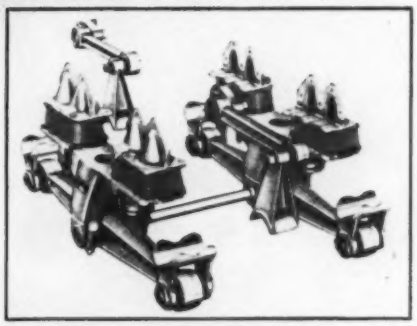

The unique design of the "load cushion" accounts for smooth, even rides in the full range of loads, empty to full. Enjay Butyl Rubber (in red) made it possible.

ENJAY BUTYL "LOAD CUSHION"

replaces steel springs in big Tractor Trailers

The "load cushion" is an important innovation in tandem suspension. Developed by the Hendrickson Mfg. Company, it is made of Enjay Butyl and replaces steel leaf springs. Utilizing the great strength and impact resistance of Enjay Butyl, the "load cushion" gives the ultimate in a soft, easy ride within the complete range of loading, from empty to full. Besides giving a smoother, steadier ride, it increases tire mileage, reduces weight and significantly reduces wear and tear on equipment.

Enjay Butyl has proved to be the answer to problems in many fields of industry. It may well be able to cut costs and improve the performance of *your* product. Low-priced and immediately available, Enjay Butyl may be obtained in non-staining grades for white and light-colored applications. Get all the facts by contacting the Enjay Company. Complete laboratory facilities and technical assistance are at your service.

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selects Collins Automatic

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tic Pilot...

Installation of Collins Automatic Pilot System on Trans-Canada Air Lines' entire Viscount fleet has begun.

TCA chose the Collins System for its *compatibility*—combination of flight control with the original, time-proven "Integrated Flight System" provides monitoring by pictorial presentation on two easy-to-read instruments. *Smoothness*—designed for airline service, this System is refined with the latest techniques to assure smooth performance of maneuvers with positive control at all times. *Modularized*—packaged in modular plug-in type units for ease of maintenance.

Collins "combined" Automatic Pilot System is the natural choice of TCA.

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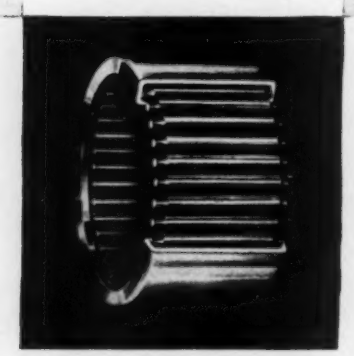
TORRINGTON NEEDLE BEARINGS GIVE YOU THESE BENEFITS

- low coefficient of starting and running friction
- full complement of rollers
- unequaled radial load capacity
- low unit cost
- long service life
- compactness and light weight
- runs directly on hardened shafts
- permits use of larger and stiffer shafts



Close-up of precision!

This Needle Roller, key to the operation of the Torrington Needle Bearing, is a microscopically precise example of Torrington craftsmanship.

In every manufacturing step, from selection of bearing materials to final polishing, these rollers are checked with strict quality control.

A full complement of rollers, mounted in a precision-made, case-hardened retaining shell, provides a maximum number of contact lines, giving the Torrington Needle Bearing a higher radial load capacity than any other anti-friction bearing of comparable size. Rollers operate smoothly with low coefficient of starting and running friction.

Torrington's experience with Needle Bearings spans the history of their development for thousands of successful applications. In seeing that you get every last ounce of performance these unique bearings can deliver, your Torrington representative is an expert: call on him at any time. *The Torrington Company*, Torrington, Conn.; South Bend 21, Ind.

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Harrison oil coolers keep critical temperatures under control on this naval transport!

Wherever the *Tradewinds* go . . . *they're cool* . . . with Harrison! Convair's R3Y-1 is a trusty taskmaster . . . transporting troops or carrying cargo. And on the job assuring reliable performance are Harrison oil coolers. You'll find lightweight, heavy-duty Harrison heat-exchangers on all types of modern aircraft . . . in every line of defense and industry. That's because Harrison's vast experience and research in the heat-exchanger field assures complete dependability—peak temperature efficiency under the most severe operating conditions. If you have a cooling problem, look to Harrison for the answer.

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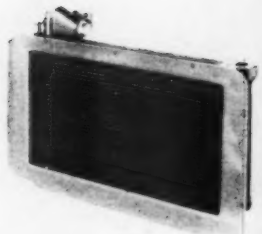


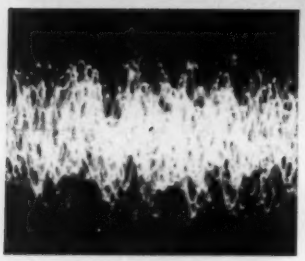
TEMPERATURES MADE TO ORDER

HARRISON

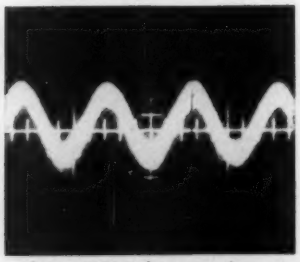
RADIATOR DIVISION GENERAL MOTORS CORP., LOCKPORT, N.Y.

GM GENERAL MOTORS

"There must be some way to beat this static!"



Scope pattern of receiver output with 50 microvolt MCW signal in the presence of precipitation static. Signals less than 2,000 microvolts are not readable.



Scope pattern of same receiver output with Hoover Model 2004 inserted in the antenna circuit. Signals as low as 5 microvolts are readable.

There is! If this aircraft were equipped with a Hoover 2004 Interference Blanker, the pilot could read the tower loud and clear despite the precipitation "noise" which is now crippling his radio reception. He would get reliable reception under adverse conditions—when he needs it the most.

Extensive tests of this unit by military and our own laboratories demonstrate remarkable communication improvement in the presence of the impulse static normally encountered in modern high altitude, high-speed aircraft.

The Hoover Interference Blanker—compact in a ¼ ATR package weighing 5½ pounds and using either 28 VDC or 110 VAC prime power—markedly increases the performance and reliability of your vital electronic navigation, direction finding or communication equipment. For complete engineering information, write to Department B-1.

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2. **HYATT WORKS WITH YOU**—Aircraft engineers like to call in Hyatt because they know we'll co-operate closely in finding new ways to break "bearing barriers".
3. **HYATT MEETS THE SCHEDULE**—We've got the tooling and quality-control systems that insure the *full* quantity—the *highest* quality—at the *scheduled* time!

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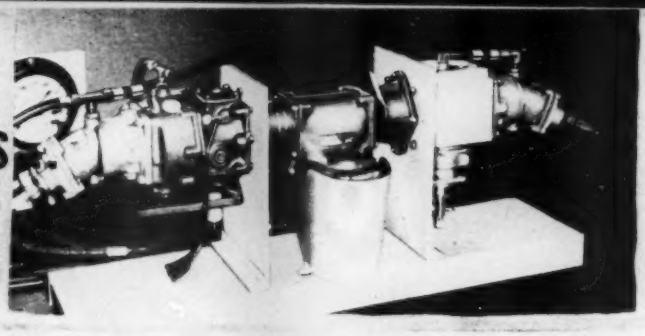
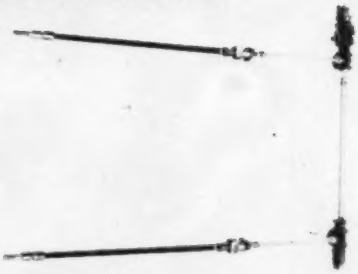
(by Western Gear)

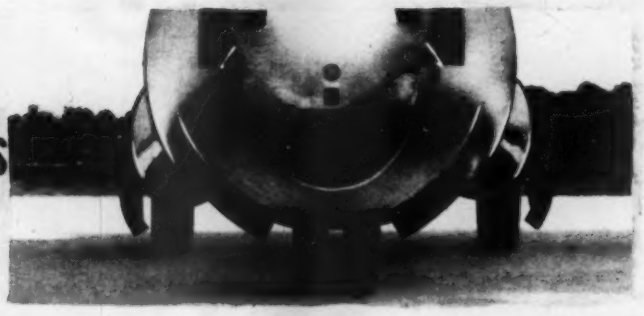




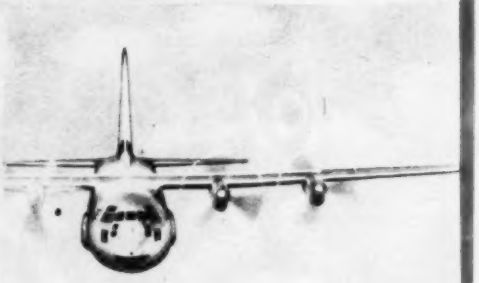
that are part of the system...

(also by Western Gear)

that lowers the wheels



on the plane that Lockheed built



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"HEARTS"

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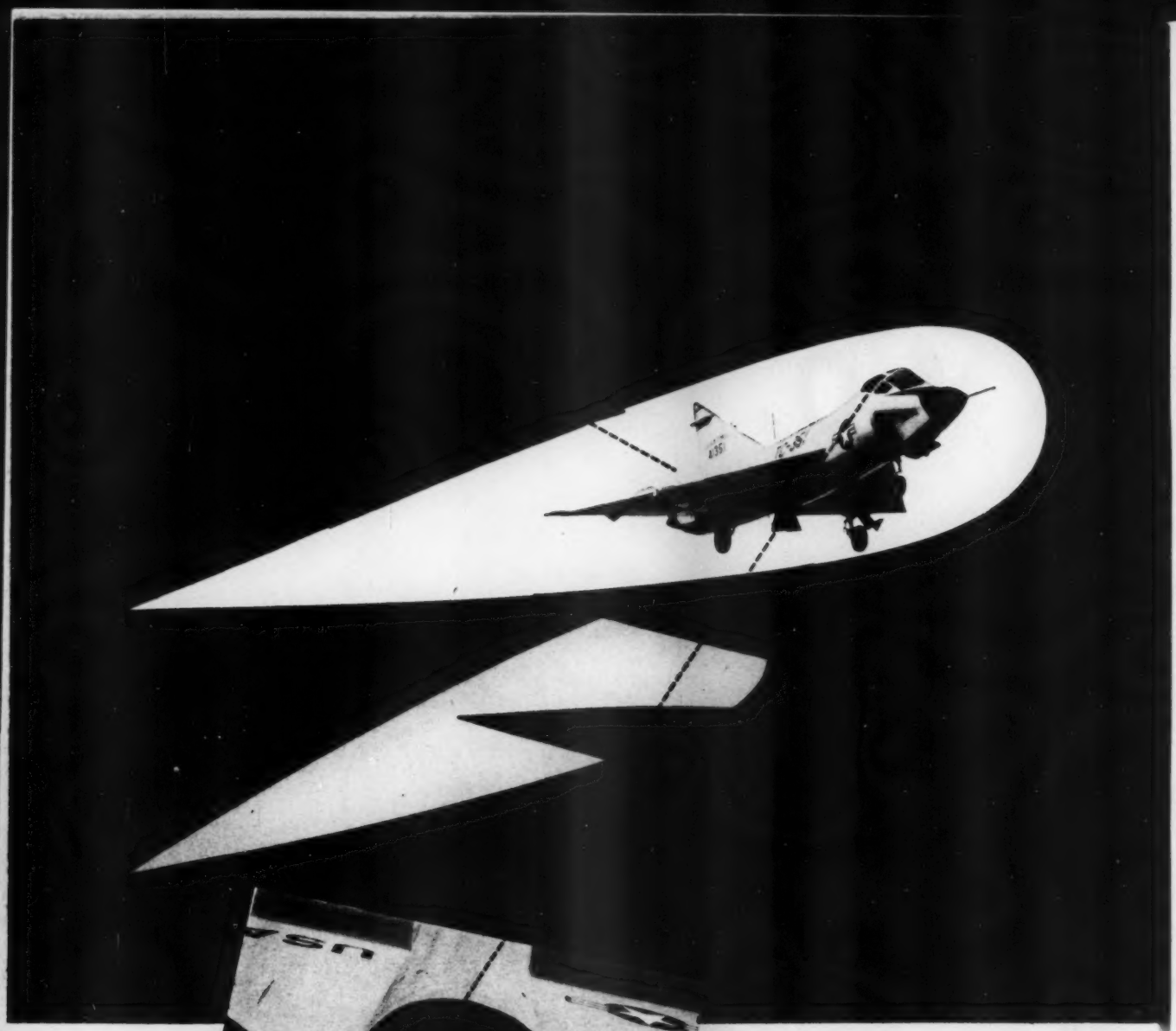
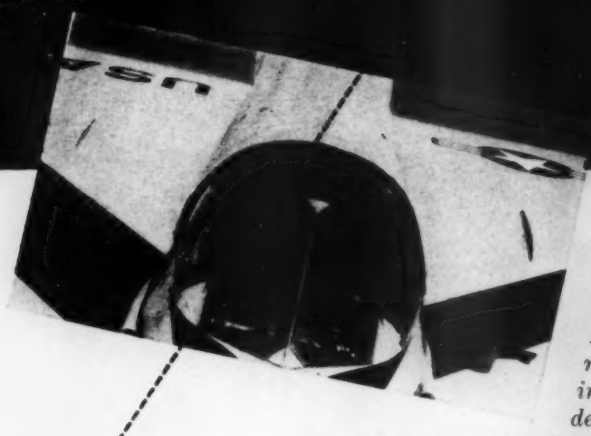
LEAR-ROMEC
makes the second best pumps in the world.

RO-21





The sighting panels of the TF-102A, the combat proficiency trainer version of Convair's F-102A interceptor, are now being produced in Swedlow's recently developed stretched acrylics.

The culmination of a Swedlow-sponsored development program extending over several years, this process involves the molecular rearrangement of acrylic sheeting by mechanical stretching, improving toughness, resistance to solvent and stress crazing, reducing notch sensitivity and resulting in a substantial saving in weight.

For information on "Stretched Acrylics" and other plastic glazing materials, contact the Swedlow plant nearest you.

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PLASTICS CO.

Los Angeles, California • Youngstown, Ohio

JANUARY 21, 1957

AVIATION WEEK

VOL. 66, NO. 3

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EDITORIAL

What the Budget Means to Airpower

President Eisenhower's Fiscal 1958 federal budget request to Congress contains good and bad news for airpower.

Brightest spots are the substantial increases asked for the National Advisory Committee for Aeronautics hypersonic research program and the Civil Aeronautics Administration's modern avionic airways and traffic control systems.

Gloomiest outlook is for the Air Force, where the Fiscal 1958 budget as it now stands will set in motion a gradual, but significant, decline in USAF combat capability.

The National Advisory Committee for Aeronautics is perhaps the most difficult agency, lumped in the Independent Offices Appropriation Bill, for both the executive and legislative branches of the government to understand. This is because of the advanced technical frontiers on which NACA battles the unknown, and, in no small measure, because decisions on its problems are not made by the more aeronautically knowledgeable committees of Congress such as the Armed Services Committee or the armed services sub-committees of the Appropriations Committees. Yet, there are few people working in aviation technology who are not indebted to NACA in some manner or another for more than 40 years of steady and often spectacular additions to the basic knowledge of this field. Whatever claim American airpower—both military and commercial—can make to international superiority rests firmly on a foundation of basic research data contributed by the NACA laboratories.

NACA: Sound Investment

With this background, it is gratifying to see the vital role of NACA in the technical advance into the hypersonic area recognized with a budget more in keeping with its responsibilities. The $41 million requested for new NACA hypersonic research facilities is a relatively small item as federal budgets go. But it represents a sound investment in the aeronautical future that will eventually yield a high return in the quality of billions of dollars of aeronautical equipment produced during the next decade.

We would be very much surprised if the new NACA Chairman Dr. James Harold Doolittle, wartime comrade in arms and close personal friend of President Eisenhower, did not have something to do with the more intelligent consideration of the NACA research problem by the federal budgetary councils.

In the vastly improved Civil Aeronautics Administration airways budget, it again would be difficult to escape the influence of another of President Eisenhower's wartime stalwarts and post-war friends—Edward P. Curtis, who is now serving as a special aviation adviser to the President. The vital necessity for a modern semi-automatic avionics airways and traffic control system is no news to the readers of AVIATION WEEK. But it has been a long, bitter battle to impress this fact on both the executive and legislative branches of the government. With as knowledgeable an adviser as Mr. Curtis at the President's ear and as vigorous and forward-looking leadership as that provided by the new Civil Aeronautics Administrator James T. Pyle, the case for the new airways system has never been more favorably presented.

It is heartening to think that a reasonable case on vital aviation problems properly presented can stir adequate action at the top level of the government. The significantly increased federal airways budget requested by the President for Fiscal 1958 should do much to get this program out of the doldrums in which it has languished for the past three years and off to a measurable start to eventual solution.

President's Endorsement

Also, encouraging is the President's strong endorsement of the Burke, Va., airport to provide the nation's capital with a terminal suitable for jet transport operations. There has been enough political log rolling and bureaucratic inertia on this problem. Unless firm action is taken on a new Washington airport this year, the jet transport era will dawn in 1960 and pass the capital by.

In the Defense Department budget, naval aviation is continued at its current levels with strong emphasis upon modernization of its first line fighting aircraft and their floating bases. Perhaps some critics will note the lack of an increase in anti-submarine warfare capabilities in the naval air program that is commensurate with the growth of the Russian submarine threat.

Army aviation will continue to prosper within the modest limits set for it by the Defense Department.

But the USAF budget presents a picture that is certain to stir the most bitter debate on airpower in Congress of the post-war era. The congressional leaders of the fight for a quantitative and qualitative boost in USAF combat strength should take heart from their victory on the Fiscal 1957 budget. For the level and tone of the Fiscal 1958 budget clearly admits that they, and not the President, were correct in the appraisal of the airpower problem last year.

Additional Funds Used

Despite constant statements by administration spokesmen that USAF could not use more funds than the President's original budget request in Fiscal 1957, the record now shows that the more than $1 billion added by the congressional debate and pressure was in fact not only usable but vital to speed the B-52 and long-range ballistic missile programs.

It is significant that USAF Secretary Donald Quarles, by no stretch of the imagination an airpower radical, is visibly unhappy over USAF's slice of the Fiscal 1958 budget. Even Defense Secretary Charles E. Wilson made a strong pitch to the White House for substantially more USAF funds than now appear in the budget. This is too complex a subject to consider further in this space but we will have more to say about it next week.

—Robert Hotz

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Horsepower

— or —

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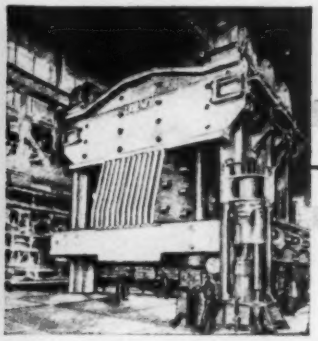

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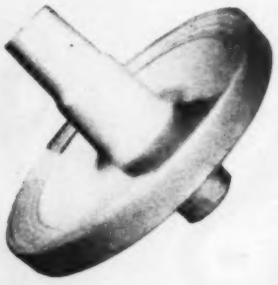

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Laurent Oppenheim, Jr., industrial management-financial relations consultant, a director, Greer Hydraulics, Inc., Jamaica, N. Y.

Harry Harris, board chairman, Chromalloy Corp., White Plains, N. Y. **Joseph Friedman** succeeds Mr. Harris as president.

Richard S. Wolf, president, Camloc Fastener Corp., Paramus, N. J. Mr. Wolff succeeds **J. Mills Summers**, deceased.

Harold Ames, Jr., president, Electro Snap Switch & Manufacturing Co., Chicago, Ill.

Maj. Gen. Francis H. Lanahan (USA, ret.), president, Federal Electric Corp., Lodi, N. J.

Dirk J. Koeleman, vice president-general manager U.S. division, KLM Royal Dutch Airlines. Also: **Paul A. Gideonse**, vice president-sales, and **Edward R. de Vries**, vice president-finance.

John Moxon, executive vice president, Carpenter Steel Co., Reading, Pa.

Jerome Ottmar, general manager, newly established Nuclear Products Division, Metals & Controls Corp., Attleboro, Mass. Also: **Sidney Siegel**, engineering manager; **Thomas Snyder**, production manager; **Dr. A. R. Mathyson**, manager contract administration.

Honors and Elections

Charles J. McCarthy, chairman of the board of Chance Vought Aircraft, Inc., has been named a member of the National Advisory Committee for Aeronautics for a five year term. Mr. McCarthy succeeds **Arthur E. Raymond**, vice president and director engineering for Douglas Aircraft Co., Inc., whose term has expired.

Capt. Click D. Smith has received the A. B. Honts Award for outstanding scholastic achievement and demonstrated ability in test aircraft at USAF Experimental Flight Test School, Edwards AFB, Calif. The award was presented by Brig. Gen. J. S. Holtoner for the first time; in the future it will be awarded each six months to outstanding graduates of the flight test class.

Mrs. J. H. Doolittle, the wife of Gen. James H. Doolittle, was presented the William J. McGough Memorial Award by Air Service Post 501, the oldest air service post in the American Legion, "For her contributions to aviation through the years." Mrs. Doolittle was the second woman to win the McGough Trophy, the first having been Jacqueline Cochran.

Cmdr. John E. Burrell, USNR, manager of television technical operations of the National Broadcasting Co., Hollywood, has received the Navy's Bronze Star Medal and an accompanying citation for his part in developing the first guided missile ever launched in wartime against an enemy.

INDUSTRY OBSERVER

► Republic F-105 program now calls for production of 16 F-105A and F-105B supersonic fighter-bombers for a thorough evaluation and test program. USAF will base future of the program upon the results of the extensive test program it has planned.

► **USAF WS-125A nuclear powered bomber program has been definitely stretched out due to technical problems in powerplant development. Four principal contractors for the program—Lockheed, Convair, General Electric and Pratt & Whitney—were officially notified of the stretchout by Air Research and Development Command early this month.**

► Grumman Aircraft Engineering Corp. is working on a new early warning radar picket plane design for the Navy.

► **Douglas Thor intermediate-range ballistic missile prototype failed to get off the launching pad at USAF Missile Test Center, Patrick AFB, Fla., last week as scheduled. Problems with launching equipment delayed the first firing of USAF's intermediate-range ballistic missile.**

► X-18 tilt-wing VTOL research plane (AW April 9, 1956, p. 57) will be built by Hiller for USAF. Air Force will furnish two Fairchild C-123 transports for the experimental work; one to be modified to the new configuration, the other to be used for spares. Navy will furnish 4,850 hp. Allison YT40A-14 turboprop engines for the project. Design gross weight will be 33,000 lb.

► **Fiscal 1958 Defense Department budget contains funds to adequately finance production of either the Army's Nike B or the Navy's Talos anti-aircraft missile for point defense. Decision will have to be made soon as to which missile will get these production funds.**

► USAF will have to make a decision soon on how much of its missile money it will allocate to IRBM work on the Army's Jupiter project at the Redstone Arsenal. Best Pentagon guess at the moment—not much.

► **Grumman Aircraft Engineering Corp. is making a strong bid for re-entry into the missile field which it left several years ago. Grumman engineers are now considering two proposals—a long-range cruise type missile and a short-range, low speed missile, both for the Navy. In addition, Grumman is working as a member of an industry team on several other proposals, including an air-to-air missile.**

► Army may give Bell Helicopter Corp. a contract for three triple-turbine-powered tandem helicopters. Company designation for the helicopter is the M-216.

► **Four KC-135 jet tanker transports have been rolled out of Boeing Airplane Co.'s Renton, Wash., plant. A fifth plane is due out by the end of the month. A total of approximately 100 flight hours have been accumulated by the first two planes to come off the line. The third is scheduled to fly before the end of the month.**

► Fairchild Aircraft Division is conducting extensive research on boundary layer control and expects to come up with an application for a modified C-123 transport sometime next year. The system will incorporate use of more powerful compressors than ever used before in order to force extra air over lift surfaces and around tail control surfaces.

► **Rolls-Royce plans a test program for its 11,000 lb. thrust RA.29 Avon turbojet to log 10,000 engine flight hours in Comet airframes by the end of 1958. Program calls for two Comet II airframes to each use a pair of RA.29 engines in the inboard nacelles on a BOAC cargo service between London and Rome and a 500 hour test program for each of the four RA.29s installed in the Comet IV prototype. Cargo operations are scheduled to produce 8,000 hours of RA.29 time and the Comet IV prototype testing 2,000 hours.**

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Washington Roundup

Hidden Budget Fuzes

Capitol Hill fireworks over the Defense Department budget are assured, but the military services will light fuzes only from behind the scenes. All prepared statements for the House and Senate committees must be submitted to Defense Secretary Charles E. Wilson by tomorrow for his approval and "coordination."

Congressional budget wrangles will be started by Democratic critics of the administration. In addition to the Symington subcommittee report on air power, critics will have material from the recent hearings on the proposed Eisenhower Doctrine for the Middle East and documents surreptitiously provided by military spokesmen. An Army colonel already is under investigation because of a "leak" to Congress from the Redstone Arsenal.

After last year's experience, Wilson is taking a cautious and friendly approach to Capitol Hill. He already has entertained some Congressional leaders at a Pentagon breakfast.

Disarmament Reaction

Former USAF Secretary Thomas K. Finletter takes issue with the administration's new disarmament proposal, recently announced by President Eisenhower and spelled out in detail by U. S. Ambassador to the United Nations Henry Cabot Lodge. Finletter's main point of challenge: The proposal rests upon "partial" disarmament, a gradual weakening of air-atomic power and other defense strength.

The President's program seeks "any reliable agreement which would reverse the trend toward ever more devastating nuclear weapons; reciprocally provide against the possibility of surprise attack; mutually control the outer space missile and satellite development; and make feasible" smaller armed forces and military budgets.

Finletter told the Senate Disarmament Subcommittee that an effective program must be for "complete" disarmament—by stages—with any reduction in the air-atomic capability reserve for the final stage. He said that, under a "partial" disarmament program, neither the U.S. nor Russia would agree to any reduction that would place it at a relative disadvantage—meaning there would be no real disarmament at all.

Both Finletter and Sen. Stuart Symington (D.-Mo.), also a former Secretary of the Air Force, dispute Secretary of State John Foster Dulles' statement that the U.S. military position vis-a-vis Russia has not deteriorated over the past few years. Symington contends that Dulles' statement is at odds with the testimony his brother Allen Dulles, head of Central Intelligence Agency, made during executive sessions of the Senate Disarmament Subcommittee last year.

Ross Unsuited?

Pentagon observers do not expect Robert Tripp Ross to return to his job as Assistant Secretary of Defense for Legislative and Public Affairs. He took a leave of absence following publication of reports that clothing firms owned by his wife and brother-in-law hold more than $5 million in military contracts.

Staffs of two congressional committees are making preliminary investigations of a possible conflict of interest, since Ross held executive positions with two of the companies, Wynn Enterprises, Inc., and Southern Athletic Co., before he took his present $20,000 a year post.

Ross, a former congressman himself, denies any conflict and insists that one document which still lists him as an officer of one of the firms is in error. Investigators are checking reports that Ross has arranged for Pentagon colleagues to buy "Wynn-Bilt" suits at wholesale cost.

Ross' handling of the censorship end of his job has brought frequent criticism from military and industry leaders and the press.

Bilateral Negotiations

The pace of negotiations on bilateral air transport agreements between the U.S. and other nations is increasing, and some significant conferences are scheduled for the next few months. A U.S. team was in Havana last week discussing the Cuban bilateral, and U.S. and British delegations will work on an overhaul of the U.S.-United Kingdom bilateral in Bermuda in February.

The Dutch will renew pressure for rights at Houston and Los Angeles when negotiations for establishment of a U.S.-Netherlands bilateral are resumed in March. Discussions also are scheduled with Belgium.

Key to the program will be the U.S.-U.K. talks in Bermuda, since most U.S. bilaterals are based upon principles established in the British pact of 1946.

New Hurdle for OSI

Continuing its battle against unnecessary secrecy in government, the House Information Subcommittee will try once again to abolish the Office of Strategic Information. This time it will use a familiar route of attack—OSI's budget.

OSI has been under attack for attempting to restrict publication of such matters as unclassified aerial photographs, government contract awards and information on radar installations. After hearings, the subcommittee and its parent committee urged abolition of OSI.

Chairman John E. Moss (D.-Calif.) now charges that the Commerce Department (of which OSI is a part) has failed to cooperate with his group by continually avoiding discussion of OSI's future and by asking for new funds for OSI in the Fiscal 1958 budget.

Moss has asked the House subcommittee which must approve OSI's budget to give "serious consideration" to Commerce's lack of cooperation.

'For Official Use Only'

Statute cited by Defense Department as its primary authority for restricting information by using the "For Official Use Only" label will be attacked in Congress.

President's Executive Order 10501 permits only three security classifications—"Confidential," "Secret" and "Top Secret." But bales of Pentagon papers bear the "Official Use" stamp—including Pentagon phone book.

Rep. John E. Moss (D.-Calif.), chairman of the House Information Subcommittee, and Sen. Thomas C. Hennings, Jr. (D.-Mo.), chairman of the Senate Subcommittee on Constitutional Rights, will introduce amendments to the 169-year-old government "housekeeping" statute (5 USC 22) which would make it clear that the law is not authority for withholding information. Rep. Clare Hoffman (R.-Mich.) a member of Moss' subcommittee, will introduce another amendment which would say that the proposed change in the law would not require the government to release security information or information it has received in confidence.

—Washington staff

$8.6 Billion Asked for Planes, Missiles

3,200 planes and $2,640 million for missiles planned for Fiscal 1958 procurement program.

By Claude Witze

Washington—President Eisenhower's proposed budget for Fiscal 1958 calls for authority to contract for $6,232 million in aircraft and $2,646 million in guided missiles. The estimated figures for Fiscal 1957, which closes on June 30, are $6,269 million for aircraft and $2,300 million for missiles.

Actual expenditures in Fiscal 1958 are estimated in the White House draft sent to Congress last week at $6,737 million for aircraft and $2,039 million for missiles. Comparable spending in Fiscal 1957 was estimated at $6,786 million for aircraft and $1,506 for guided missiles.

For the aircraft industry, the budget means that production of piloted military aircraft will continue to decline at a faster rate than at any time since it began going down in 1955. New contracts will be signed in Fiscal 1958 for about 3,200 aircraft. Of these, the Navy will get 1,220, almost as many as the Air Force, which is scheduled to sign contracts for 1,515. For Fiscal 1957, USAF was given authorization to buy 1,900 planes. Army, in Fiscal 1958, will contract for about 470 aircraft.

Wing Goal Chopped

The Defense Department announced bluntly that USAF's 137-wing goal—firm as recently as last summer—has been chopped to 128 wings. Air Force sources indicated after a study of the budget that 120 wings would be a more realistic estimate of the new goal. The 137 wings had been promised by the end of Fiscal 1957.

According to Defense Department figures, USAF at the end of Fiscal 1958 will have 45 wings in the Strategic Air Command, 32 in the Air Defense Command and 51 in the Tactical Air Command. The TAC strength will include 15 heavy, medium and assault troop carrier wings.

The official figure of 128 wings includes four wings never included in the 137-wing goal set for this year. They are one Matador wing, activated but not manned or equipped, and three C-123 assault transport wings, formerly included among the support aircraft and not counted in USAF's wing program.

Major Loss for TAC

On top of this, it now appears that, over the next few years, SAC will eliminate six fighter wings and Air Defense Command two day-fighter wings. TAC faces almost certain loss of at least six wings—one bomber, two fighter-bomber and three day-fighter wings.

Defense Department spokesmen would offer no details on what the future holds for USAF. They said the Air Force must outline its own program when hearings are started on Capitol Hill. And they cited President Eisenhower's budget message. In it, the President said:

"The introduction of new equipment and weapons with vastly greater combat capability is also having a powerful impact on concepts of military strategy, tactics and organization.

"The combat power of our divisions, wings and warships has increased to such an extent that it is no longer valid to measure military power in terms of the number of such units."

'Reasonable' Protection

Based on this approach, the President said he is convinced his budget provides a "wise and reasonable degree of protection for the nation."

This was followed in the budget text by the news that SAC and TAC fighter wings will be reduced.

The Army's "growing guided missile capability" and the increasing effectiveness of SAC's heavy bomber wings were cited as reasons for the change. When SAC's B-52 wings are complete, they will have 45 aircraft each, 50% more than the B-36 wings they will replace.

It was made clear that USAF contracting in Fiscal 1958 will include very few trainers and practically no transports, a decision that is certain to change the program for the Douglas C-133 and C-132. These aircraft had been expected to take up much of the lag in airlift available to move the Army's streamlined atomic-age divisions that depend upon airlift for effectiveness.

On the subject of USAF funding, it was disclosed that about $700 million of the extra $900 million voted by Congress late in its last session has been obligated. But the speedup of the Boeing B-52 production program last year was not financed out of these funds. Most of the $700 million obligated has been applied to the intercontinental and intermediate range ballistic missile programs. The B-52 speedup was

Air Power Program

	Actual				Preliminary	Planned
	End FY 1953	End FY 1954	End FY 1955	End FY 1956	31 Dec. 1956	End FY 1958
Air Force						
Wings	106	115	121	131	134	128*
Active Aircraft Inventory	19,103	21,601	23,694	26,760	26,514	24,398**
Navy						
Carrier Air Groups	16	16	17	17	17	17
Carrier Antisubmarine Squadrons	19	19	19	19	19	20
Marine Aircraft Wings	3	3	3	3	3	3
Active Aircraft Inventory	13,308	13,073	12,821	12,317	11,785	11,790
Army						
Antiaircraft Battalions (Incl. Missile Battalions)	114	117	122	133	133	127
Active Aircraft Inventory	3,200	3,633	3,539	3,573	4,198	5,031

* Strategic 45; Air Defense 32; Tactical 51.
** 690 Civil Air Patrol Planes are being Transferred from USAF Inventory.

Major Expenditures, Obligations

	Expenditures by Major Budget Category (Millions of Dollars)			New Obligational Availability		
	FY 1958 (Est.)	FY 1957 (Est.)	FY 1956 (Actual)	FY 1958 (Est.)	FY 1957 (Est.)	FY 1956 (Actual)
Air Force						
Aircraft	4,983	5,076	5,181	4,519	4,786	5,480
Guided Missiles	1,213	860	641	1,793	1,948	700
Electronics & Communications	600	646	514	359	410	197
Production Equip. & Facilities	170	180	217	300	390	84
Research & Development	670	650	632	661	712	593
Operations & Maintenance	4,143	4,051	3,659	4,232	3,750	3,615
Navy						
Aircraft	1,645	1,595	1,831	1,631	1,483	761
Guided Missiles	264	221	195	428	352	238
Electronics	153	138	103	186	189	151
Production Equip. & Facilities	91	70	60	48	68	19
Research & Development	500	480	449	505	514	474
Operations & Maintenance	2,484	2,305	2,319	2,593	2,390	2,386
Army						
Aircraft	109	115	134	82	.....	.....
Guided Missiles	562	425	333	425	.....	.....
Electronics	174	142	153	10	.....	.....
Production Equip. & Facilities	84	87	164	.....	.....	.....
Research & Development	410	410	410	400	410	352
Operations & Maintenance	2,971	2,684	2,541	3,022	2,791	2,643

financed from a $547 million supplemental appropriation, the Defense Department said.

R & D Funds Down

In the critical field of research and development, the Defense budget provides for new obligations of $1,651 million, down from last year's $1,704 million.

Again, USAF absorbs the biggest share of the slash, with a cut to $661 million from $712 million. Army is scheduled to get $400 million, a reduction of $10 million, while Navy is reduced from $514 million to $505 million.

Defense spokesmen pointed out there is a great deal of money going into research and development from other accounts and claim that the appropriations do not provide a good measure of the work done. Because R&D frequently includes test and evaluation of new hardware, the Department estimates that the total effort to bring new weapons to the point of production for use probably will call for almost $6 million.

Most significant figure for operations and maintenance in the proposed budget is that of the Air Force, pegged at $4,232 million in new authorization. The figure is $482 million more than last year.

Funds For Avionics

The electronics industry will find it difficult to pinpoint the Defense Department potential in the new budget. As usual, all avionic equipment is included in the proposed figures for aircraft and missiles. As a rule, 40 to 50% of missile expenditures are for electronic equipment. In aircraft, the figure ranges from 20 to 30%.

For ground electronic equipment—which would include radar, SAGE early-warning equipment and communications hardware—the Department total is $535 million in new authorizations, down $44 million from Fiscal 1956. Most of this comes from USAF, which is allocated $359 million against $410 million last year. Navy's figure is $186 million, down from $189 million. Army is recommended for $10 million, first money it has had for this purpose since the budget for Fiscal 1954.

Other highlights from the proposed budget:

• **USAF's total budget** recommendation is $17,756 million. The Fiscal 1957 estimate for obligation is $17,690. USAF made an early estimate several months ago that it would need in excess of $20 billion.

• **Budget provides $100 million** for an Air Force Industrial Fund. This is working capital to put Military Air Transport Service on a "corporate" basis for its new role as single manager agency for the Defense Department.

• **There is no provision** for military manpower reduction. Funding is provided for a million-man Army, with 875,000 on active duty in the Navy and 925,000 in USAF. Army divisions will be reduced to 17, and six new Atomic Support Commands will be added to its organization.

• **Navy will continue with 17 carrier**

Defense's 'Third Dimension'

Washington—The Defense Department this year introduced a new "third dimension"—Direct Obligations—in its annual budget presentation.

The Direct Obligation presentation provides figures obtained by adding the usual New Obligational Authority—the amount requested of Congress—to the funds left over from last year, receipts for reimbursements and what is salvaged from the sale of military scrap.

Result: Direct Obligations are substantially higher than the customary compilations of New Obligational Authority and Expenditures. For example, the New Obligational Authority sought in the Fiscal 1958 budget is $38,500 million. The Direct Obligations will be $40,594 million. Actual Expenditures are estimated at $38,000 million.

The Defense Department now believes that the new "third dimension" is the best measure of its budget outlook. Figures compiled for Aviation Week readers are the familiar requests for New Obligational Authority used in past years as a measure of the contracting possibilities facing the aircraft and electronic industries in the coming year and Expenditures which are the best index of deliveries and sales.

air groups and move from 19 to 20 carrier anti-submarine squadrons. There is provision to start work on a nuclear-powered carrier and missile ships.

The carrier Oriskany will be provided with a canted deck. Four merchant ships will be converted into radar picket vessels. Almost all the 1,200 newly-authorized Navy aircraft will be fighter types.

• **Army's Redstone Arsenal**, home of its missile effort, is not scheduled to receive any specific USAF funds despite the fact that Defense Secretary Charles E. Wilson has said that the Jupiter project will be under Air Force cognizance in Fiscal 1958. A Defense spokesman suggested that funds allocated direct to Wilson's office could be used at Redstone.

• **Marine Corps** will continue to maintain three divisions and three wings.

• **Work of Atomic Energy Commission** on military reactors will include propulsion units for submarines, surface ships, aircraft and missiles.

NACA Asks 50% Budget Boost

By Evert Clark

Washington—The National Advisory Committee for Aeronautics is asking Congress for $118.2 million in new authorizations for Fiscal 1958—a 50% increase over last year's requests. Four new hypersonic research facilities and a 10% increase in personnel are included.

Construction requests total $41.4 million—nearly three times the $14 million requested for Fiscal 1957.

NACA's budget reflects the great emphasis its laboratories are putting on the problems of aircraft and missile flight at very high speeds and temperatures.

Langley

Langley Aeronautical Laboratory at Langley, Va., is seeking authority for:

• **Hypersonic Physics Test Area—$1,987,000.** This would include storage facilities for high explosives and hazardous fuels and oxidants; solid and liquid fuel rocket test cells for velocities up to Mach 20 and above; a projectile test unit; chemical jets providing temperatures up to about 11,000 deg. F for research on rockets of light-weight, high thrust and short duration, and hypervelocity guns for research relating to missile countermeasures and meteor impact problems.

• **Hypersonic Helium Blowdown Tunnel—$796,600.** This closed-cycle tunnel, with a 12 by 12 in. test section, would cover a range from Mach 10 to 25. It is needed for research on satellite and missile problems that will be encountered at speeds attainable in outer space. NACA said no wind tunnel is available for Mach numbers above about 10, and an air tunnel for speeds above about Mach 14 is not likely because of the extreme pressures and temperatures.

• **High Speed Leg for Unitary Tunnel—$750,000.** This item originally in the Fiscal 1957 budget, would cover two fixed nozzles providing a range from Mach 7 to 10.

• **Data Reduction Center—$3,067,200.** NACA is now asking for authority to build this facility but is not asking for the funds.

• **Modification of the 26 in.** transonic tunnel to provide an alternate test section and extend the Mach range from 1.4 to 4. This is necessary to study aerodynamic flutter problems. Cost would be $346,000.

Ames

Ames Aeronautical Laboratory, Moffett Field, Calif., is seeking authorization for a number of projects, including:

• **Hypersonic Tunnel—$11,731,000.** This tunnel, with a 3.5 ft. test section, would cover a range from Mach 5 to 10. The test section would be large enough to allow scale duplication of aircraft structural components for studies on heating and other aerodynamic problems.

• **Bypass system** for the nine-by-seven foot supersonic test section of the Unitary Plan Tunnel that would increase the Mach capability from 2.35 to 2.6. Cost, $100,000.

• **Boundary layer removal** in the 14 ft. transonic tunnel, increasing Mach capability from 1.2 to 1.4 and allowing doubling of model size. Cost, $4,435,000.

• **Flow improvement** of the 11 ft. transonic circuit of the Unitary Plan Tunnel by altering the method of venting the test section and changing the bypass air entry at the downstream end. Cost, $255,000.

Lewis

Lewis Flight Propulsion Laboratory, Cleveland, Ohio, is asking authority for:

• **Rocket Systems Research Facility—$5.7 million.** This would include two new buildings and modification of another; research stands, cells, and laboratories for research on rocket systems.

• **Expansion of Propulsion Systems Laboratory**—$5.8 million. This would include installation of equipment to investigate performance of engines in excess of Mach 4.5 and permit more extensive use of high energy fuels in full-scale test.

• **Modifications to component research** Facility for nuclear propulsion—$5,655,000. This would include a hot laboratory for handling and investigation of reactor components and a radiation analysis laboratory to determine damage to components.

Lewis also is seeking authority to add 115 acres to its installation.

Wallops Island

Pilotless Aircraft Research Station at Wallops Island, Va., wants $2.56 million for modernization of obsolescent instrumentation equipment. It would include two new tracking radars, telemetry receiving equipment, and an increased range Doppler system.

National Advisory Committee For Aeronautics

(In Millions)

	FY 1956 (Act.)	FY 1957 (Act.)	FY 1958 (Est.)
General Operating Expenses	60 1	64 1	76 8
Construction	12 6	14	41 4
Langley	3 3	7 4	4 9
Ames	.9	.9	16 5
Lewis	8 3	5 7	17 4
Pilotless Aircraft Station	.1	....	2 6

CAA Asks 57% Boost To Push Airways Plan

A record $385 million was requested for the Civil Aeronautics Administration for Fiscal 1958—a 57% increase over 1957.

President Eisenhower placed major emphasis in his budget message upon the need for increasing the capacity of the air traffic control system, and the $149.5 million requested for air navigational facilities was almost four times the original Fiscal 1957 budget request. Subsequently, however, the figure was raised, and Congress approved a total of $175 million.

CAA's budget request includes funds for 10 airport surface detection equipments (ASDE), including "taxi radars" which enable control tower operators to see whether distant runways and

Civil Aviation

New Funds
(In Millions)

	FY 1956	FY 1957	FY 1958 (Requested)
CAA TOTAL	170	245	385
	MAJOR PROGRAMS		
Administration Operations:			
Federal Airways	98 1	120	172
Flight Operations and Airworthiness	13 7	14 9	19 1
Airports	2 6	3 6	4 2
Establishment of Air Navigation Facilities	23	75	149
Airport Development		30	35
Air Navigation Development	1 0	1 5	2 0
CAB TOTAL	56 9	20 8	57 5
Administration	4 4	4 6	5 7
Payments to Air Carriers	52 5	16 2	51 8

taxi strips in adverse weather are clear of traffic.

New Navigation Aids

Other new navigation and terminal area aids in the proposed budget:

- **137 VOR omniranges,** 580 have been installed or previously authorized.
- **18 Vortac navigation facilities,** 53 installed or previously authorized.
- **54 Equipments** for converting VORs to Vortac; 172 installed or previously authorized.
- **30 ILS instrument landing systems,** 170 installed or previously authorized.
- **21 Long-range radars** for enroute traffic control; 32 installed or previously authorized.
- **20 Air traffic control beacon systems,** 18 installed or previously authorized.
- **23 Airport surveillance radars** (ASR); 47 installed or previously authorized.
- **64 Runway approach lights,** 38 installed or previously authorized.
- **32 Sequenced flashing approach lights,** 5 installed or previously authorized.
- **12 Airport traffic control** tower service; 211 installed or previously authorized.

The budget does not seek any additional precision approach radars (PAR) to supplement the 23 systems already installed or authorized.

A supplemental appropriation of $26 million will be requested for 1957 to "cover the cost of integrating two existing short-range navigation systems into a single system capable of meeting the navigational needs of users of air space," the President said. He had reference to the Vortac system which was adopted last September by the Air Coordinating Committee in its decision on the controversial Tacan issue.

The President recommended an appropriation of $195 million to operate and regulate the federal airways, a 40% increase over the $136.8 million requested for Fiscal 1957.

It was estimated that an appropriation of $35 million will be required in Fiscal 1958 to meet obligations incurred under the contract authorizations provided under the grants-in-aid program for airports. A total of $231.5 million has been authorized for fiscal years 1956 through 1959 under the amended Federal Airport Act.

New Washington Airport

Eisenhower also supported Burke, Va., as a logical site for an alternate airport in the Washington area and said a supplemental appropriation of $35 million will be requested for Fiscal 1957 to cover construction of the new airport.

Airspace user charges were advocated by the President, who said "government aids to aviation confer substantial benefits upon the users of air space. As the cost of these benefits rise, it becomes increasingly appropriate for the users to share with the general taxpayers in paying for them."

Airlines in the past have expressed a willingness to absorb their share of airways costs but have held that taxes paid by the airlines are equivalent to user charges.

XB-68 Canceled

Washington—Air Force has canceled the Phase II prototype of the Martin XB-68 tactical bomber but will continue to finance new design studies on a low-priority basis.

Glenn L. Martin Co. won the design competition from Douglas Aircraft Co. several months ago and work on the prototype was under way.

The Fiscal 1958 Air Force budget cuts back Tactical Air Command. President Eisenhower said in his budget message that "the Army's growing guided missile capability is decreasing its dependence on the Air Force for close support of troops."

Air Navigation Development Board will emphasize air traffic control and developments and a $2 million appropriation was requested for its work during fiscal year 1958 compared to $1.5 million in Fiscal 1957.

In his budget message, the president called for a $413 million appropriation for the CAA. However, this amount includes the $63 million contract authorization for airports less $35 million appropriation used to liquidate the contract authorization.

CAB Budget

Civil Aeronautics Board's budget request for Fiscal 1958 provides for substantial increases in the Board's staff and in the level of appropriations for airline subsidy.

CAB wants to increase its budget for salaries and expenses from $4,645,000 in the current fiscal year to $5,725,000 for Fiscal 1958. The increase would raise the Board's staff from the 625 employes authorized this year to 750 in the coming fiscal year.

CAB's subsidy request for Fiscal 1958 is increased sharply from the abnormally low Fiscal 1957 level of $16.2 million to a total of $51,810,000 for next year. The actual level of subsidy paid to the airlines remains constant at about $47 million.

The difference between 1957 and 1958 subsidy appropriations is due to the fact that CAB had a substantial carryover from 1956 to help pay the Fiscal 1957 subsidy bill, and the Board recovered some subsidy from the carriers during the year to further cut 1957 subsidies. The Fiscal 1958 subsidy total includes $4,124,000 which CAB owes but which was not covered by the current $16.2 million appropriation.

The Board's program for the coming fiscal year calls for increased spending in all of its fields of activity. Spending for economic regulation is scheduled to increase from $2,532,050 in Fiscal 1957 to $3,130,950 in Fiscal 1958; spending for safety regulations will increase from $344,300 to $480,300; for accident investigation and analysis from $681,000 to $766,700; for legal staff activities from $327,000 to $465,000; for executive direction from $299,000 to $344,300, and for administrative and service activities from $441,650 to $537,750.

Guided Missile Contract Awarded to Temco

Washington—Navy's Bureau of Aeronautics announced last week that it has awarded a $60 million contract for a new guided missile weapon system to Temco Aircraft Corp., of Dallas.

Macmillan Government Slashes Defense Funds; Air Force Suffers

London—First of an anticipated series of defense slashes has been announced by the Macmillan government, with the major portion of the cut, an estimated $45-million, coming out of aviation funds.

Largest cutback announced is the cancellation of orders for 100 Hawker Hunter fighters. The Ministry of Supply says the cut was due to a "reduction in RAF requirements." Financial saving is expected to be some $28-million.

The sweptwing Hunter is the first-line fighter of the Royal air force. Although a spokesman for the Air Ministry said there is no dissatisfaction with the Hunter, many quarters regard it as an obsolescent aircraft in view of more advanced fighters now in operational service with the U.S. and Russian air arms.

The aircraft canceled are of the latest V6 type.

More to Come

The cut is regarded as the first of a number which can be expected as the Macmillan government works out a new role for Britain in world affairs and also tackles the task of bringing some order out of the present chaos in British military aviation.

The Defense Ministry also announced that Britain's aerial "weekend warriors" are being disbanded. The move will dissolve the Royal Auxiliary Air Force and Royal Navy Volunteer Reserve Air Branch. The saving is expected to total nearly $17-million.

The RAF Auxiliary includes 20 fighter squadrons and the Navy Air Branch includes 11 fighter and anti-submarine squadrons.

In addition to these economies in the aviation field, the War Office announced there will be no call-up of army reserves for part-time training this year.

Target date for disbanding the RAF and navy reserve air units is March 10. Flying already has ceased and the remaining time will be devoted to administrative windup. A side effect of the action is expected to be a saving of 17-million gal. of aviation fuel a year—an important factor at the moment in fuel-short Britain.

Mission of the 20 fighter squadrons in the RAF Auxiliary has been to supplement Britain's defenses against air attack other than high-altitude nuclear attack. The squadrons have been flying Meteors and Vampires. It was decided many months ago that there would be no program to equip the squadrons with the more modern Hunters.

"Technical development is continually reinforcing the view that the main threat to this country is from high-altitude attack," the Air Ministry says, "other forms of attack which might be countered by less advanced types of aircraft are, in consequence, less likely to materialize."

The naval reserve units have been flying Avengers, Attackers, Gannetts and Seahawks. The Admiralty says the move disbanding the squadrons was necessary "to ensure the replacement and re-equipment of the fleet as a whole within the limit . . . which our economy can stand."

An Air Ministry spokesman refused to comment on what further cuts in British aircraft production are in the offing. He said the year's defense estimates now are under preparation.

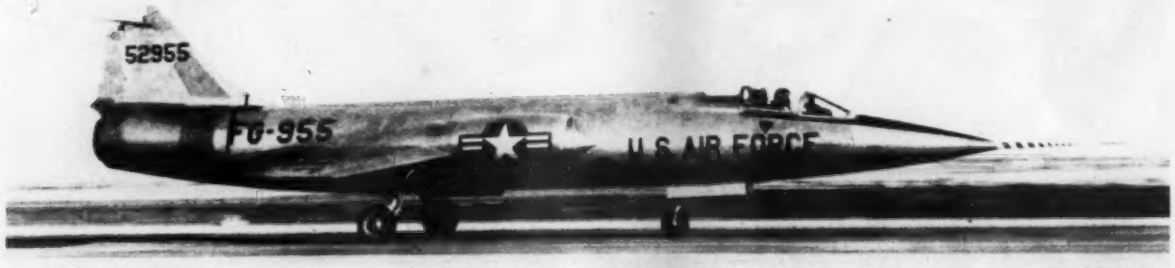
The recent change in government makes it impossible to predict in detail what course defense cuts may take but it is known that the Macmillan government feels that Britain in the past has been overcommitted in terms of her economic ability to bear the military burden.

Technical Switch

Emphasis of the new government on improving the nation's industrial position also is expected to favor release of scientists and technicians from defense positions into general industry. This could mean a curtailment in research and development funding in many fields.

Some political observers believe the new government will work out a foreign policy on the basis that the United Kingdom never again will "go it alone" as it did in the Suez crisis. Such a policy obviously would eliminate the necessity for military forces capable of "going it alone" and permit a substantial cut in defense spending.

While this would bode ill for present high profits throughout the British aircraft industry, it could result in a much tighter, and in the long run more



F-104A's Spiked Inlets

First officially released picture showing Lockheed F-104A supersonic spiked inlets confirms in every detail the exclusive Aviation Week sketch published earlier (AW Apr. 23, 1956, p. 35). Lockheed's California Division is now producing the F-104A and its two-seater counterpart, the F-104B. The "A" version is scheduled to join Air Defense Command squadrons in the near future. Plane is powered by the General Electric J79 turbojet that recently thrust the Grumman F11F-1F to unofficial world's speed and height records (AW Dec. 24, p. 26). F-104A measures 54 ft. 9 in. overall length, is 13 ft. 6 in. high and has a wingspan of 21 ft. 11 in.

effective, aircraft and guided missile program.

One of the most important changes in Prime Minister Macmillan's cabinet lineup was the appointment of Duncan Sandys to the post of Defense Minister. He is regarded as one of the bright young men in the Conservative Party and undoubtedly will not miss a chance to make a name for himself in a field which is wide open for effective action.

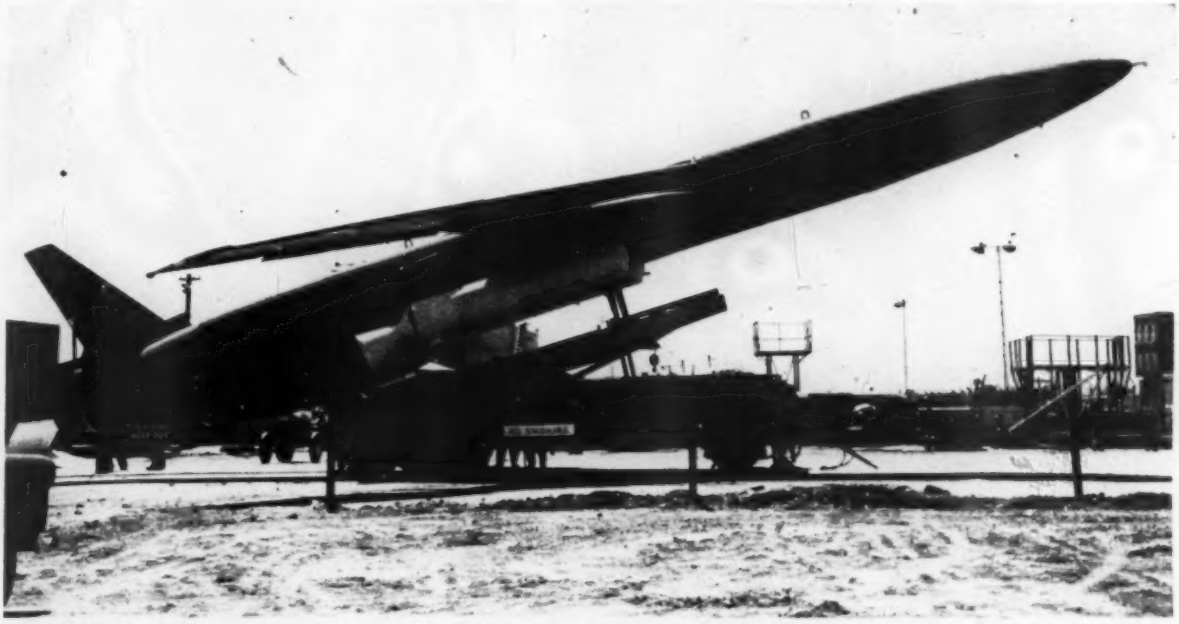
Expansion of Britain's V-bomber force is expected to continue with added emphasis on development of a supersonic interceptor for defense. Increased dependence on the U.S. for guided missile development can be expected.

Cutback of the Hawker Hunter also may mean increasing confidence in the English Electric supersonic P.1 fighter which is scheduled to succeed it. A production order already has been placed for this fighter. Hawker itself is developing a supersonic fighter with its own funds.

The cut in British aircraft spending also could foreshadow closer cooperation with the U.S. in the field of military aviation. Britain often has been criticized for belated paralleling of U.S. developments. If the two nations take on complementary roles in the aircraft and guided missile fields, much of this duplication and its resulting financial waste could be avoided.

Armstrong-Whitworth Aircraft firm, which produces the Hunter together with Sea Hawks and Javelins, already has announced it is dismissing between 500 and 600 skilled workers. A spokesman for the company says none of its contracts were canceled but that defense requirements have "eased."

Despite the layoffs, the firm is recruiting some 100 technicians for guided missile research and for development of its new freighter aircraft.



SNARK on launcher shows wing tanks for first time, confirming earlier drawing in Aviation Week (AW Mar. 26, p. 46). Launcher is zero-length type and is air-transportable in Douglas C-124 Globemaster. Twin rocket boosters have canted nozzles to direct thrust through Snark center-of-gravity to minimize dissymmetry.

Snark to Become Operational With SAC

Northrop's SM-62 Snark intercontinental pilotless bomber is scheduled to become operational on a limited basis with units of Strategic Air Command in about one year.

Acceptance of the Snark to augment the striking power of SAC gives some scale to the timetable for service use of the long-range ballistic missiles—Convair Atlas, Martin Titan and Douglas Thor—now under development and nearing the test-flight stage.

Pre-production quantities of Snarks have been built at Northrop's Hawthorne, Calif. plant for at least six years, along with the ground support equipment. Availability of the missile, which cruises at high subsonic speed and is controlled by a Northrop-developed hybrid inertial guidance system, figured into the Air Force decision.

Official details just released of some of the Snark's characteristics confirm in almost every respect an exclusive engineering analysis of the intercontinental missile published in Aviation Week Mar. 26, p. 46.

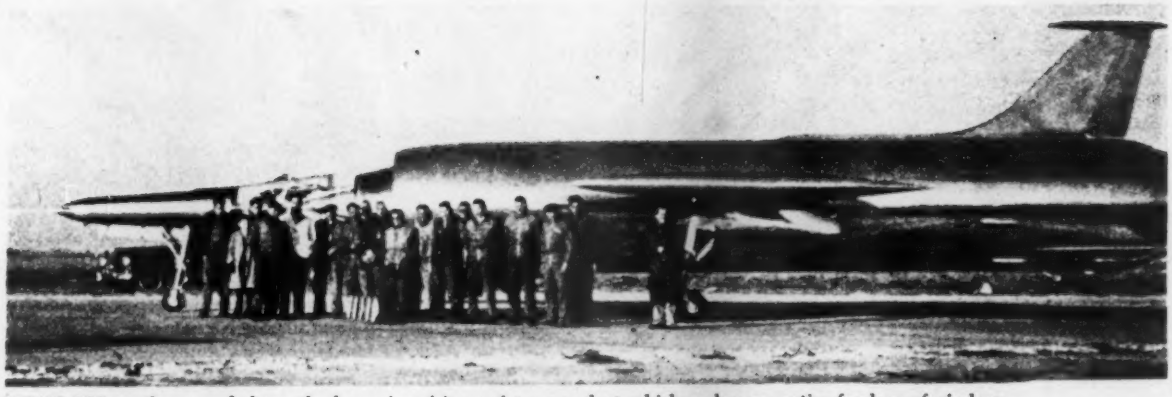
Snarks will be launched from a zero-length launcher, which is air-transportable. The launchers are towed by a tractor or half-track prime mover and give the Snark mobility so that any small, flat place on the ground can become a launching site. With three launchers set up at a single site, 20 Snarks can be handled and fired during a 24-hr. period.

Length of the launcher is 29 ft., width 10 ft., and its retracted height is seven feet. Sixteen three-foot diameter tires bear the weight.

At launching, the Pratt & Whitney J57 turbojet is developing full thrust and a pair of rockets boost the Snark off the launcher. The total thrust accelerates the bird to flying speed and Snark climbs to a high altitude for its Mach 0.9 cruise. Near the target it pushes over into a dive and slams into the target at supersonic speed.

It can carry any first-priority warhead, including nuclear charges, over a range listed in the 5,000-mi. class.

Dimensions of the Snark: overall length, 69 ft.; wingspan, 42 ft.; overall height, 15 ft.



LEDUC 022 on the ground shows the huge size of its ramjet powerplant which makes up entire fuselage of airplane.

Leduc 022 Prepared for Tests Aimed

By David A. Anderton

Rene Leduc's 022 ramjet-powered supersonic interceptor, designed for performance in the Mach 2 region, is being readied for a series of flights aimed at Mach numbers approaching 4.0.

Trials in the high supersonic Mach range are planned for next month. Specifically, the pilot is going after a 4,000-km./hr. mark, equivalent to 2,485 mph.

Should the record attempts be successful, they will stand as high points in the almost single-handed efforts of Rene Leduc to establish the ramjet as a piloted aircraft powerplant.

Flying Powerplant

The Leduc 022 is a flying engine, like its predecessors. Its basic powerplant is a ramjet engine more than 6 ft. in diameter and about 39 ft. long. Translating its design thrust at altitude to an equivalent sea level static thrust would rate the ramjet at 132,000 lb.

In addition, there is a Sneema Atar turbojet mounted inside the ramjet body to provide power for takeoff and acceleration to operational speed. Normally a ramjet requires a velocity somewhere around Mach 0.4 to light off and burn successfully.

Gross weight of the 022 is 13,200 lb., of which about one-third is fuel. Wing and tail surfaces are swept back approximately 50 degrees. Overall length of the 022 is about 56 ft. and it stands about 15 ft. high in the three-point attitude.

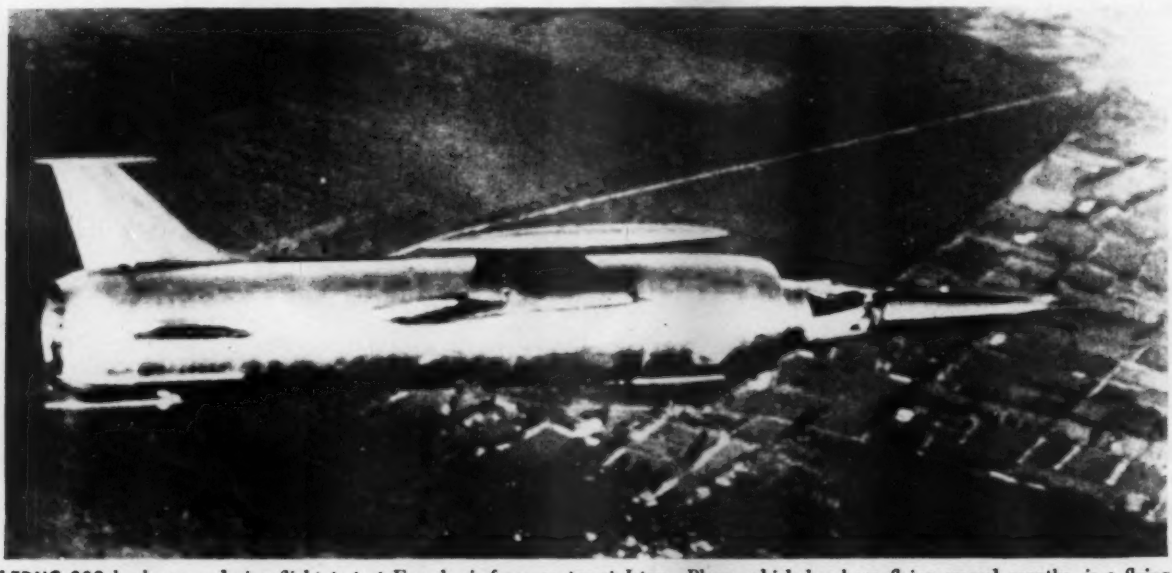
First prototype 022 was completed in June 1956 and has been on flight status for several months. Second should be almost completed.

Leduc History

Rene Leduc has been working on ramjet-powered aircraft for 24 years. His first proposal dates back to 1933; it showed an airplane basically the same as his current 022: a winged, finned powerplant, with a cockpit in the nose section. A model of this aircraft was shown at the Paris Show in 1938.

In 1935 Leduc's experiments bore first fruit; an experimental ramjet he developed produced positive thrust in a near-sonic airstream.

In January 1936, Leduc presented some of the conclusions of his experiments in a note to the Academie des Sciences. In April he gave a public



LEDUC 022 banks away during flight test at French air force center at Istres. Plane, which has been flying several months, is a flying engine with a basic powerplant consisting of a ramjet more than 6 ft. in diameter and about 39 ft. long.

TAKEOFF powerplant is Snecma Atar.

at Mach 4.0

lecture under the sponsorship of the Societe de Navigation Aerienne. By June of that year, he had obtained stable combustion in his ramjet and had completed a service test on the engine.

The French Air Ministry, through its Technical Service, ordered the 010 as an experimental airplane in 1937 and Leduc began construction. The following year he took over a section of the Breguet factory on loan and started model tests with the complete aircraft, the wings and the powerplant.

Dodging Germans

Diffuser tests were made in 1939 but the work was interrupted by the German invasion of France a year later. Leduc bundled the parts off to Toulouse and started to pressure the Vichy government to allow further effort on the project. This order was given in 1943.

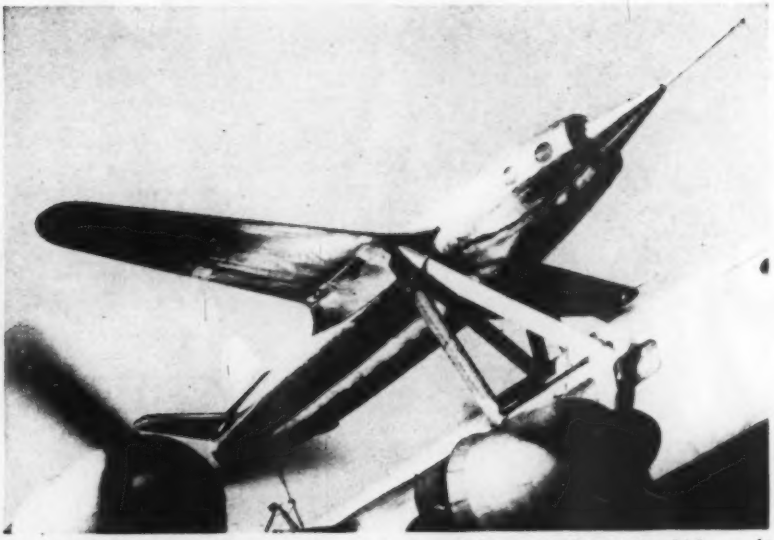
It was short-lived: the Toulouse works were bombed in 1944 and the shop and its contents were destroyed.

In August 1944 France was liberated. Leduc built a new plant and started all over again on the 010, which was completed the following year. Development of the supporting system for air-launching the 010 took more time and it was not until November 1946, that necessary preliminary tests could be made.

Captive flights followed, with the 010 suspended above a Languedoc carrier aircraft on a structure of struts. Some glide flights were added to the program to get a general idea of the handling characteristics before turning on the juice.

First Fire-Up

After two and one-half years of preliminary work, the first powered flight was made in April 1949. The carrier went into a shallow dive from 13,000 ft. and at 10,000 ft. the pilot of the



LEDUC 010 was first ramjet-powered man-carrying airplane, served as test vehicle, made first flight in April 1949, from suspension system like that above on Languedoc.

LEDUC 021 powerplant shows as concentric rings in this rear view of plane. Speeds on the order of Mach 0.9 were reached during flight tests.

LEDUC 021 in flight did much development work for current 022 interceptor model. Air plane established a mark of 15,700 fpm. rate of climb at altitude of 16,400 ft.

010 cut in the burners. The engine fired, and he separated from the carrier.

Staying in the dive, the pilot cut in additional burners—which were zoned in that airplane to give some measure of thrust control—and pushed up the speed to about 450 mph. Flight duration was about nine minutes.

In later flights, the 010 reached a speed of over 500 mph. at 36,000 ft. At that altitude, the rate of climb was 8,000 fpm., a figure still most impressive.

Three prototypes of the 010 were completed. The second was a duplicate of the first; the third was equipped with Turbomeca Marbore turbojets at the wingtips for cruise and landing operations.

French Air Ministry support continued with the order for a pair of Leduc 021 aircraft, larger and with greatly improved performance over the 010 trio.

First flight of the first 021 was in May 1953.

Like their ancestors, the 021s were carrier-launched from a mother airplane bearing a suspension system much like the one used for the 010.

The 021s were subsonic; speeds on the order of Mach 0.9 were reached during flight tests. Estimated sea level rate of climb was close to 40,000 fpm. At 16,400 ft. the plane established a mark of 15,700 fpm. rate of climb. Ceiling was calculated to be on the order of 65,000 ft.

The 021 prototypes currently are being used to develop components for the P22 interceptor.

Bomber Defense Missile Uses Hawk

BOMBER DEFENSE MISSILE VEHICLE in these first exclusive pictures is adaptation of the Raytheon Hawk. Layout confirms earlier report of Hawk configuration (AW Dec. 10, p. 23). Overall length of Hawk is about 10 ft., and diameter is about nine inches. Long delta wings appear to be one-piece cast surfaces and are bolted to the fuselage in a shear connection. Tail section is flared out, not necessarily for increased stability, but to provide space for four rectangular housings located 90 degrees apart around periphery of rocket motor nozzle. Spacing of housings suggests they contain steering apparatus. Note markings of fins to give positive identification of angular position in roll during test flights.

Cornell Aeronautical Laboratory has been designated systems engineering manager for an Air Force bomber defense missile (BDM) system based on the test vehicles adapted from the Raytheon Hawk 1.

The Hawk, an anti-aircraft missile under development by Raytheon for Army Ordnance through its Redstone missile arsenal, was used for tests of the Cornell-developed control system. First firings of BDM vehicles have been made from rocket-propelled sleds at the Holloman Air Development Center.

This action is the latest in a series of off-again, on-again moves that have characterized the BDM program almost since its inception. Previous action occurred late last year when Air Force issued stop orders on two contracts then underway (AW Nov. 5, p. 28).

At that time, re-evaluation of the entire BDM program was being done for the Air Council. Affected by the order were two technical teams: Republic Aviation Corp. plus Westinghouse, and General Electric Co. plus McDonnell.

Republic has since received a termination order on its contract.

The present Air Force program is similar in concept, although much smaller in scale to its ballistic missile approach. Cornell is the counterpart of Ramo-Wooldridge and functions as systems engineering manager for the BDM.

Cornell is providing engineering assistance to the Air Force just as Ramo-Wooldridge advises the Western Development Division.

New Navy Trainer

Washington—North American T2J jet trainer is about to go into production for Navy use. T2J will be powered by the 3,400 lb. thrust Westinghouse J34 engine.

First delivery is expected in December.

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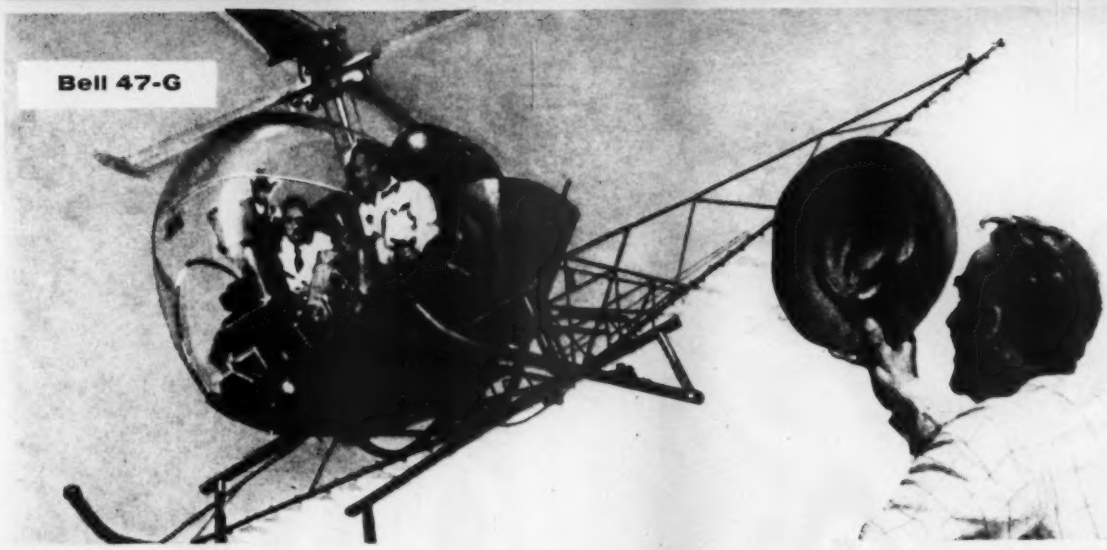

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Hughes Aircraft Unveils Two Place Helicopter for Military Use

By Irving Stone

Culver City, Calif.—Hughes Tool Co.'s Aircraft Division unveiled its new two-place Model 269 helicopter in a series of flight demonstrations last week. The copter previously had been flight-demonstrated for high ranking military personnel (AW Dec. 24, 1956, p. 23).

Designed to provide a simple, light-weight, rugged and economical configuration, the Model 269 has been developed by Hughes in anticipation of a military requirement for an optimum size two-place copter.

The rotary winger already has been flown by eleven Army evaluation test pilots.

Military Orders

Hughes officials will make no comment on possible military orders, but AVIATION WEEK has learned that Army interest has progressed to the point of processing an order for an evaluation quantity—5 to 10 of the copters. First of these machines probably will be delivered to the Army Aviation Board at Ft. Rucker, Ala., late this year.

While slanted initially for military application, the copter will be offered to government agencies, such as police, fire, forestry, and highway engineering departments, and to a wide field of industrial activities. Estimated cost, after manufacture of the 500th vehicle, is $15,000—a relatively low figure.

The copter has been designed for a normal gross of 1,500 lb. This would be comprised of 850 lb. empty weight, 150 lb. fuel, 100 lb. baggage and 400 lb. for pilot and passenger. At an overload gross weight of 1,750 lb., payload is boosted to 550 lb. The copter already has hovered out of ground effect at the 1,750 lb., figure.

Top speed is 95 mph. Cruising speed is 75 mph. Range with two-man crew (400 lb.) and 350 lb. of equipment is 170 mi., or 2¼ hr.

The Model 269 features open steel-tube construction. Engine is a 170 hp. 4-cylinder, air-cooled Lycoming 0-340-A1A that is secured in place below the seat structure with four bolts. The engine provides ample power for cruising at reduced engine loads and for hovering at high altitude or on hot days.

Single main rotor, 25 ft. in diameter, has three fully articulated all-metal blades. Blades have a U-shaped nose extrusion, which is in effect the main structural component. The skin wraps around the extrusion and is joined at the trailing edge over internal fillet. There are no ribs in the rotor blade.

Configuration of the blades is straight from root to tip, but Hughes is building an experimental version of a twisted blade for the copter, to improve hovering and forward speed capability.

Friction dampers instead of hydraulic, dampers are used in the rotor hub.

The engine is connected to the gearbox right angle drive with a system of seven belts. Half of these belts can be lost and full power can still be transmitted. If continuing tests prove out the desirability of the belt drive it will be fixed as a design feature.

An idler pulley located between the engine and gearbox pulleys serves as a manual clutch to engage or disengage the engine to the gearbox. Inside of the gearbox pulley is an override clutch to automatically disengage the rotor from the engine, to permit auto rotation.

Shock Struts

The skin-type undercarriage carries four shock struts (two on each side) which affords better control of the machine when contacting the ground and makes for softer auto rotational touchdowns.

Tailboom uses triangular rib makeup and terminates in a tail skid just before the tail rotor. Just forward of the skid is a fixed horizontal stabilizer.

Easy maintenance has been stressed in the design. The rotor system (hub and blades), engine and gearbox each may be removed without disturbing either of the other units.

Extensive ground testing is now underway to establish component reliability. Hughes is aiming at 1,000 hr. life for components such as blades and gearbox.

The flight program also is continuing. About 30 hr. of flight time have been chalked up since the copter first flew in October last year.

Model 269 Specifications

Main rotor:	
Three fully-articulated, all-metal blades, 25 ft. dia.	
Airframe	Open steel-tube construction
Engine:	
Four-cylinder, 170 hp. air-cooled Lycoming 0-340-A1A	
Empty weight	850 lb.
Useful load	900 lb.
Gross weight	1,750 lb.
Dimensions	8½ ft. high, 19 ft. 5 in. long
High speed	95 mph.
Cruising speed	75 mph.
Cruising range	170 mi
Normal endurance:	
2¼ hr. (23 gal. fuel capacity)	
Rate of climb, sea level	1,400 fpm.

FIRST pictures of Hughes Model 269 helicopter in preview flight at the Culver City, Calif., plant. Ultra-light two-man vehicle is 8½ ft. high, weighs 850 lb. empty, has a cruising range of 170 mi. at 75 mph. Engine is 4-cylinder, air-cooled 170 hp. Lycoming.

Martin P6M Escape Systems Evaluated

Wichita, Kan.—Beech Aircraft Corp. will evaluate emergency escape systems for the Navy-Martin P6M SeaMaster to determine whether dynamic forces at the time of ejection at high speeds are within the limits of human tolerance.

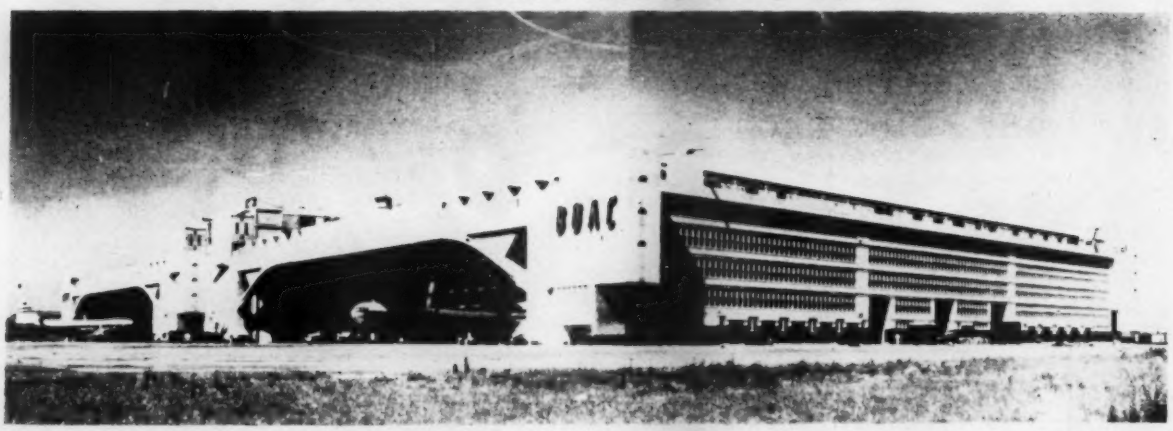
Under subcontract to the Glenn L. Martin Co., Beech will instrument anthropomorphic dummies here for ejection from Navy's supersonic rocket sled at the Naval Ordnance Test Station, China Lake, Calif.

In the crash of the second XP6M-1 SeaMaster (AW Nov. 19, p. 34) four Martin employes ejected safely, seconds after the plane went into a tight inside loop at Mach .88. It had slowed from a higher speed.

The engineering research program on the escape systems is not a result of either SeaMaster crash, having been planned before they occurred.

Convair Division Receives New F-102A Contract

Convair Division of General Dynamics Corp. has received its fifth Air Force contract for supersonic, all-weather F-102As. New contract totals $74 million. Five USAF fighter-interceptor squadrons are now flying F-102As.



BOAC headquarters building at London Airport, world's largest of its type, has total floor space of 17 acres. Concrete, cantilevered structure houses four large hangars accommodating total of 12 Britannia-sized aircraft, also contains offices.

BOAC Seeks All-British Turbine Fleet

DC-7C Atlantic service begun in stop-gap attempt to recover traffic lost after grounding of Comets.

By L. L. Doty

London—British Overseas Airways Corp. has embarked upon a re-equipment program designed to give it an all-turbine fleet by 1960 and an all-British fleet by 1962.

The long-range equipment plan got under way earlier this month with the inauguration of DC-7C service on BOAC's Atlantic route. The DC-7Cs, however, are looked upon as only a stop-gap measure.

Their chief purpose is to give BOAC an opportunity to regain some of the traffic lost to other carriers when the grounding of the Comet I in 1954 left the company with an odd assortment of aircraft unsuited for the highly competitive transatlantic market.

Program Highlights

The overall program was organized so as to keep peace at home by patronizing British manufacturers without losing any time in the race for international travel business. Some of its highlights:

• **Bristol Britannia 102 service** to South Africa will be inaugurated on Feb. 1. Britannia schedules to Australia will be introduced in March; Tokyo service will start in June. In August, Bombay-Colombo-Singapore service will begin, and Singapore-Hong Kong service via Calcutta will get under way in September. The Britannia schedules will be increased the following year as more experience and aircraft utilization is realized. By that time, the 15 Britannia 102s—10 have been delivered to date—will enable BOAC to cover all its eastern routes with turbine aircraft, relieving piston-engine planes for other services or conversion to freighters.

• **Comet IV service will start** early in 1959, replacing the Britannia on the Australia run. Four months later, the Comet will take over all Far Eastern routes and the released Britannias will replace piston-engine service on the East and West African routes. Last stage in the Comet program will be introduction of the turbojets on the South African routes, so that, by the end of 1959, BOAC will have an all-turbine service in the Eastern Hemisphere. Nineteen Comet IVs have been ordered by the airline.

• **In the Western Hemisphere**, DC-7Cs will operate as tourist and tourist first-class combination flights, while the Boeing 377 Stratocruisers will handle all first-class traffic (AW Jan. 14, p. 47). Twice weekly DC-7C flights will begin in April to San Francisco, where around-the-world connections will be made with Qantas Empire Airways.

• **Britannia 312 operations** will replace the Stratocruisers on the Atlantic route following delivery of the big turboprop transports about mid-1957. The airline may encounter some delay in implementing this service because of the serious pilot shortage in England (AW Jan. 7, p. 45). BOAC has 18 of the 312s on order.

• **DC-7Cs eventually will be sold** to obtain dollars to help pay for the 15 Boeing 707 jet transports the airline has on order with deliveries beginning in 1960. The 707s will replace the DC-7Cs on the Atlantic run, giving the airline complete turbine coverage on all its routes.

• **The de Havilland 118**, now in the design stage, is expected to make its first flight in 1962. This airplane, powered by Rolls-Royce Conway by-pass engines, will ultimately replace both the Comet IV and the Boeing 707 to provide BOAC with its all-British fleet.

Comet I Setback

The airline never fully recovered from losses suffered when its jet equipment program was abruptly interrupted by the grounding of the Comet I. With 21 Argonauts, 16 Constellation

BASIL SMALLPEICE, BOAC managing director, believes pure jets will not present great problems.

749s and 16 Stratocruisers to cover some 85,000 miles of international routes, BOAC has been without sufficient available seat-miles and the fast, long-range aircraft needed to compete with the more modern equipment of its competitors.

Despite the equipment setback, the airline has earned a profit in each of the past four years. In the fiscal year ending last March, the accumulated deficit was erased and a surplus was recorded for the first time in company history. This was due in part to the sale of spares and other assets.

Despite this, BOAC Chairman Gerard d'Erlanger has not been optimistic over Fiscal 1957 results. Last spring, he warned that the company faced a possible $4 million deficit this year. However, the improved traffic situation during the year probably will offset at least some of the heavy expenses incurred by the introduction of the DC-7C and the Britannia.

Load Factors Dip

Load factors dipped from 63.7% in Fiscal 1955 to 61% last year. And although available ton-miles increased 21% in Fiscal 1956, they fell short of the capacity BOAC had forecast for 1956 Comet operations by 9%.

Chartered equipment helped account for the increase in available ton-miles as well as the 32% jump in the number of passengers carried. But revenues rose only 20% because of the higher percentage of tourist-class traffic flown last year. In Fiscal 1956, 53% of the airline's customers traveled tourist-class as compared with 45% for the previous year.

BOAC's operation of the Comet I between May 1952 and April 1954 produced at least one major compensating factor—it gave the airline a practical turbojet experience that none of its competitors possess. BOAC flew more than 25,000 hours in scheduled service and carried close to 55,000 passengers during Comet I service. A series II Comet will be delivered shortly to provide additional operating experience with preliminary flight trials. Basil Smallpeice, BOAC managing director, said recently that "our experience with the Comet I taught us that, whereas pure jet aircraft demand the application of new techniques, their operation does not present any very great problems."

Flame-Out Solution

The airline was threatened last September with another disappointing reversal in its equipment program when the Britannia's Proteus engines developed flame-out troubles caused by the formation of ice crystals in the air intake ducts under certain weather conditions. Crystals breaking away from the walls of the intakes extinguished the flame in some, or all, of the combustion chambers.

Last month, Bristol—in cooperation with the Royal Aircraft Establishment at Farnborough, the National Gas Turbine Establishment and BOAC—apparently solved the flame-out problem by a modification of the flame tubes of the Proteus engines. Three test flights under severe icing conditions have demonstrated the effectiveness of the modification.

Capt. H. O. Houchen, BOAC deputy operations director, told AVIATION WEEK the flame-out danger was removed by two steps. The first was by the installation of platinum glow-plugs in the combustion chambers to insure an automatic re-light system that was both sure and swift.

The second measure was decided upon after viewing the flame-out tubes by television while the engines were in operation. It was observed that ice build-ups occurred most consistently in the flame-tube tunnels or cross-over nozzles in the one and eight positions.

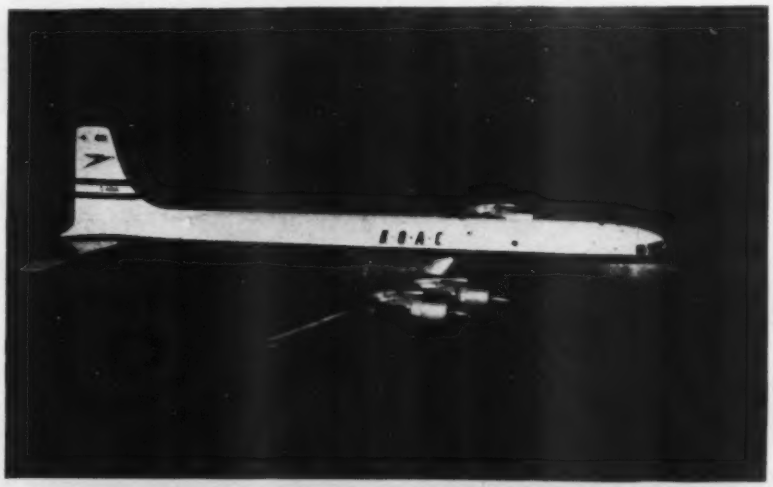
As a result, fairings or baffles constructed of an alloy metal have been fitted to the tunnels to deflect the ice particles away from the flame tubes.

Britannia Schedule

More than 7,800 hours flying time have been accumulated in Britannia testing and training with BOAC accounting for more than 3,650 hours of the amount. The Proteus engines have compiled 55,000 hours of development operation. The engines develop 4,120 total equivalent horsepower or 3,650 shp., plus 1,220 lb. thrust.

The Britannia service scheduled to begin on Feb. 1 will be operated three times weekly between London and Johannesburg. The mixed-class configuration will include 19 first-class slumberette chairs (fully reclining seats with foot rests) in the rear of the cabin and 48 tourist seats in the forward section. The flights will serve Rome, Khartoum, Nairobi and Salisbury.

London-Sydney service will begin on



NEWEST BOAC PLANES are Douglas DC-7C, above, now in transatlantic service; and Bristol Britannia 102, below, scheduled for London-Johannesburg service next month.

March 2. A first-class flight carrying 39 slumberette seats will offer once-a-week service. Twice weekly, a mixed-class configuration Britannia—with 42 tourist seats and 19 slumberette seats—will be operated. Floor seat tracks and removable bulkheads on the Britannia permit quick revision of seating configuration.

The Britannia 102 is powered by four Bristol Proteus 705 engines, each developing 3,900 ehp. It has a maximum payload of 25,000 lb. for a still air range of 3,500 statute miles. Cruising speed is 350 mph. at 25,000 ft. Initially, engine overhaul time has been set at 500 hours, but this period will be increased as flight time is accumulated.

Loss in Far East

African services last year had a load factor increase of from 64% to 67% but the airline suffered a sharp loss on its Far Eastern routes. According to d'Erlanger, the replacement of the Argonauts by the Constellations 749s on all first-class service cut deeply into the margin of profit.

Available seat-miles remained the same despite the change-over in equipment, but the high purchase price of the DC-7Cs as an interim fleet added to the overall operational expenses. In addition, d'Erlanger said the Constellations were no match for their competition. The airline attempted to counteract this disadvantage by installing slumberette seats on the Constellations and by employing Asian stewardesses on Far Eastern segments of the routes, but indications are that only fast, up-to-date equipment will turn the tide in its favor.

During the Suez crisis, when most Middle East airports were closed to the British, BOAC maintained full scheduled operations to Africa and the Far East without canceling a single flight, although major reroutings created a number of operational problems.

North Atlantic Route

The North Atlantic route accounts for about one-third of BOAC's business. Its share of the Atlantic traffic grew steadily from approximately 18% of all traffic in 1947 through 1949 to a peak of over 40% in 1951.

However, BOAC's share of all trans-atlantic traffic had declined to about 30% by 1955.

Prospects for an early economic recovery are not brightened by the fact that the airline will be operating no less than five different types of aircraft for the next few years—Argonauts, Britannias, Constellations, DC-7Cs and Stratocruisers.

BOAC, however, is well equipped to handle this multiple equipment problem, and its hangar facilities, office space and maintenance and overhaul equipment are among the most modern available.

Four big buildings at London Airport—two of which are still under construction—will fulfill both present and future requirements. The headquarters building, the largest of its type in the world, covers a ground area of eight-and-one-half acres and has a total floor space of 17 acres. The building is 870-ft. long, 432-ft. wide and 99-ft. high. Four large hangars are housed within the building, each with a door opening 300-ft. wide, a clear height of 55-ft. and a depth of 140-ft. Each of the four hangars will hold three Britannias for major overhaul service. Doors operate electrically.

The building is constructed of reinforced concrete on the cantilever principle. It is divided into four parts by a central hall running the full length, with headquarters offices at each end. The building will accommodate 4,000 employes and four restaurants will handle 830 people at one time.

The airline has installed unique maintenance docks for its Britannia 102 that also can be adjusted to handle the Britannia 312. The docks are constructed of tubular steel with teak wood flooring. They are equipped with 12 telephones, water, compressed air and a complete system for ventilating the gas tanks.

Overall height of the structure is 36 ft. It is 120-ft. long. Power operated elevators are located at both sides of each engine so that mechanics can adjust the working platform to any level to suit their purposes. The dock is equipped with three platforms on each side of the vertical stabilizer.

The entire structure folds into the airplane after the plane has been towed into the hangar eliminating wasted man-hours in preparing for major overhaul.

The dock can be opened into a V-shape by means of hinges. When the aircraft is towed into position, each side of the dock is simply rolled back into position alongside the aircraft, sharply reducing the number of hours in preparing a plane for overhaul.

FCC May Establish New Policy On TV Towers As Air Hazards

By Craig Lewis

Washington—Federal Communications Commission will make a decision this spring that may establish a new policy on tall television towers and their potential as aviation hazards.

If it adheres to its examiner's philosophy, the commission's decision will follow a more realistic pattern in assessing the menace of tall towers to air navigation.

The FCC will have an opportunity to reassess its television tower policy when it acts upon an application for a 2,000 ft. tower at Selma, Ala. The present policy was established a year ago in the controversial Enid, Okla. case, and the commission may liberalize the relatively rigid standards it set down then for judging tall towers which fail to consider fully such factors as aircraft malfunctions, pilot error and weather hazards.

Support for a more liberal approach developed last month when the FCC examiner in the case recommended that the Selma application be denied. He advised denial on the grounds that the tower would be a potential air hazard and create certain financial and economic difficulties.

In finding the tower a potential menace to air navigation, the examiner relied primarily upon a test of "reasonableness," and he refused to judge the issue strictly by the rigid standards established in the Enid case.

On the air hazard issue, the examiner decided that the Selma tower would either create intolerable hazards for planes flying according to present procedures or cause revisions and relocations of the present patterns of flying performed in the area.

The FCC official said he found that "no reason has been shown why aviation interests should accept or be subjected to such revisions and relocations. Under the test of reasonableness . . . the tower must therefore be adjudged a potential hazard to air navigation."

The Enid case, in which FCC set its standards on towers, was the first one in which aviation interests fought a tower application to a final decision at the FCC. In an earlier case at Roswell, N. M., the military withdrew its objections, and the airlines reluctantly followed.

In both cases, the issue was one of comparative hazards. Towers existed at both Roswell and Enid, and the question was whether the new, taller towers would be more of a hazard than the old towers.

The FCC overruled the objections of the airlines and the military in the Enid case, and granted the application for a 1,350 ft. tower. In its decision, the commission established a set of standards for assessing the potential menace to air navigation of a tall tower.

Strictly interpreted, these standards are rather rigid, and they allow no mar-

gin for error from such realities as pilot error, rule violations or aircraft malfunctions. Under such an interpretation, a tower would have to be an obvious menace to air navigation to be ruled out.

Selma Proposal

The Selma case differs from the previous cases in that it is purely a question of whether the proposed tower is or is not a potential hazard. There is no present tower with which to compare it.

The case stems from an application by the Deep South Broadcasting Co. to build a television tower 1,993 ft. high at a site approximately 50 miles from Selma and 23 miles south of Montgomery. The tower would be 19.6 miles south-southeast of Montgomery's Dannely Airport and 24.8 miles south of Maxwell Air Force Base. Allenport Airport, Craig AFB, Ozark Army Airfield and Lawson Army Airfield are also in the general area.

The Selma tower proposal was submitted to the Air Coordinating Committee's Atlanta Regional Airspace Committee for review. The Air Force, Navy, Army and Civil Aeronautics Administration members approved the tower, with the FCC and Civil Aeronautics Board members abstaining. The examiner said the group thought the tower was too high, but that, under existing agreements and criteria, it had no choice but to approve the tower.

The matter then went to the ACC's Airspace Panel in Washington where Army, Navy and Air Force members voted to disapprove the tower. The CAA representative termed the tower a hazard, but said his agency had no grounds upon which to base disapproval.

Since the decision was not unanimous, the case went to the FCC for hearing.

Air Hazard Issue

FCC included the air hazard issue in the case, along with questions of financial fitness and economic competition among television stations. Department of Defense, Air Transport Assn. and the Aircraft Owners and Pilots Assn. represented aviation interests in the case proceeding.

The applicant sought approval for the television tower application on the grounds that it would comply with all established criteria. Support for this contention was offered through the testimony of Lowell Wright, a consultant hired by Deep South to study the aeronautical aspects of the tower site.

Answering Deep South's argument, the FCC examiner said that, while the criteria do not categorically eliminate the proposed tower, they do require a special study of the situation.

The examiner said "the decision is not limited to a determination of whether the tower would conform to criteria but must rest on the broader basis of whether the tower would or would not constitute a reasonable hazard on the basis of all relevant and material evidence."

Analyzing the testimony of the military and civil witnesses who objected to the tower site, the examiner found that the tower would require the raising of minimum en route altitudes on two airways and the raising of the minimum terrain clearance on a third airway.

Other minimum altitudes would have to be raised in the Montgomery area, and the examiner determined that the tower would be a hazard to northbound traffic on airway B-55 and to both IFR and VFR traffic generally in the southeast quadrant of either the Montgomery VOR or Maxwell Range Station.

The examiner also pointed out that the tower would interfere with IFR traffic in the area and increase the hazards of thunderstorms. The Montgomery area has a relatively high incidence of thunderstorms compared with the rest of the U.S.

Other factors in the case were the studies presented by the Defense Department which demonstrated the difficulties involved in detecting and avoiding the tower and its guy wires with various types of aircraft.

The applicant argued that pilots flying in the area would have the means to avoid a collision with the tower, but the examiner said the mathematical probability that most pilots would see the tower in time to avoid it, or that the low frequency signal on airway B-55 would not deviate "is slight comfort to the aviator."

"The applicant's argument has assumed a degree of perfection in the conduct of flights that is simply not realistic," the examiner said. "If assumptions are made—and in a case such as this they must be made to interpret the evidence—they must be reasonable."

The examiner concluded that the existence of the tower at its proposed site would create "intolerable hazards" for aircraft flying in the area or would cause revisions and relocations of present flying patterns. He finds no reason why aviation should have to accept such revisions and relocations.

The examiner based his findings and recommendations on a liberal, "reasonable" interpretation of existing standards in the light of the situation at Selma. Now the FCC has to decide whether it wants to take a fresh look at the precedent it established for air hazards in the Enid case.

Armstrong-Whitworth Offers New Turboprop Cargo/Passenger Plane

London—Armstrong-Whitworth Aircraft is offering its new turboprop freight/passenger AW 650 series aircraft in both four-engined and twin-engined versions.

Details of the new freightliner have just been released. Flight of the first prototype is scheduled before the end of 1958.

The four-engined AW 650 is to be powered by four Rolls-Royce Dart R. DA 7 engines and the twin-engined AW 651 with two Rolls-Royce Tyne engines. The company also is proposing a military version to be known as the AW 660. This would be equipped with four Darts.

Armstrong-Whitworth also is offering a choice of fuselage lengths in combination with either the two- or the four-engined aircraft. It says the new airliner thus will provide a payload-range spectrum wide enough to cover over 90% of the world's air route requirements.

The firm is planning initial production of ten aircraft. The prototype will be a four-engine freighter with Dart engines.

Wingspan of the new aircraft will be 115 ft., length 86 ft. 9 in. and height 27 ft. Initial certificate of airworthiness application will be for a gross weight of 76,000 lbs. At this weight, takeoff length is expected to be 3500 ft. with a cruising speed of 296 mph. at an altitude of 25,000 ft. Flight deck is laid out for use by a crew of either two or three.

Propellers will be 11 ft. 6 in. Rotols.

Fuselage will have full width loading doors at both fore and aft ends to speed freight handling. This "tube" arrangement is made possible by supporting the fuselage from a high wing with the tail structure supported by twin booms from the inner nacelles.

The hold will be 10 ft. wide with a clearance of seven feet under the spars. It is designed for six abreast seating in the tourist version and will be able to carry up to 82 passengers. Passenger access door is on the port side forward of the rear freight door. Fuselage floor will be at truck bed height. Hold capacity will be either 3,000 cu. ft. or 3,700 cu. ft., depending on fuselage length.

Armstrong-Whitworth also is offering an unpressurized version as a car

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SAN FRANCISCO—nonstop to Chicago and onestop to Washington
CINCINNATI—onestop to San Francisco
DETROIT—onestop to Los Angeles
BOSTON—onestop to Los Angeles
WASHINGTON—nonstop to Los Angeles, onestop to San Francisco

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ferry which would have a width of 14 ft. 6 in. at floor level. Otherwise identical with the 650 series, it will carry six cars and 30 passengers on short and medium stages.

High aspect wing of the freightliner will be light alloy two-spar construction with double slotted flaps. These will be hydraulically operated. Gross wing area is 4,419 sq. ft. Conventional rudder, elevator and aileron are operated by tension-compensated cables and spring tabs. Emergency systems are air operated.

Retractable tricycle undercarriage is wide track, operated by hydraulic jacks. Main wheels retract rearwards into inner engine nacelle. Hydraulic brakes with non-skid device will be standard. Moderate tire pressures are planned for operation from unprepared fields.

Hot air de-icing is ducted from power plant heat exchangers. Pressurization system is operated from three engine-driven cabin blowers with a maximum pressure differential of 5½ psi.

Armstrong-Whitworth gives the following anticipated payload-range characteristics with reserves: 500 statute miles at 28,000 lbs., 1,000 mi. at 26,500 lbs., 1,500 mi. at 22,000 lb., 2,000 mi. at 17,500 lb.

"Maintenance and inspection aspects are being given special consideration," the company says. "Systems are an important source of defects and delays in civil aircraft operation and only well-proved components and equipment will be employed in the AW 650."

The aircraft is designed for maximum economy and high utilization in either all-freight, freight/passenger, or all-passenger configurations.

"It will be possible to reduce the overall costs per unit load handled to the lowest levels yet made possible in air transport and certainly well below the levels now necessary with the obsolescent passenger aircraft which are carrying the bulk of the world's air freight," Armstrong-Whitworth asserts.

The firm says the consequent reduction in freight rates will be of the "greatest significance" in expanding air freight traffic.

The aircraft is designed to meet U. S. certification requirements.

American, Eastern Get N. Y.-St. Louis Nonstop

Washington—Civil Aeronautics Board will allow American Airlines and Eastern Air Lines to operate nonstop flights between St. Louis and New York in competition with Trans World Airlines' present service.

The CAB announced in a release on the Eastern Route Consolidation Case that it has voted to authorize the new nonstop service for American and Eastern. The decision becomes final when the Board's opinion and order are issued.

Eastern's new authority to operate nonstop between the two cities will stem from the consolidation of Route 47 and Route 5. Eastern will be restricted from operating a nonstop service between New York and Charleston, W. Va., and the carrier's request to service Cincinnati on the New York-St. Louis route was denied.

The Board extended American's Route 25 beyond Cincinnati to St. Louis to permit New York-St. Louis nonstop flights, but American will be restricted from flying nonstop between St. Louis and Washington, Baltimore or Philadelphia.

The CAB decided to lift a restriction which currently prohibits TWA from operating Cincinnati-Washington nonstop service. The Board also voted to remove a restriction from American's authority so the carrier will be able to operate nonstop flights between Louisville and Washington.

American's application to extend its Route 4 between St. Louis and Cincinnati was denied.

CAB Reclaims Subsidy For Pacific Operations

Washington—The Civil Aeronautics Board has proposed new temporary mail rates for Northwest Airlines and Pan American World Airways' 1954 transpacific operations that call for the two carriers to surrender $7,342,000 in subsidy for the period.

The CAB has been working on final mail rates for the two airlines' 1954 pacific operations for four years, and the new temporary rates are designed to cover only their breakeven need until final rates are set.

Northwest received mail pay totaling $4,913,000 for its 1954 international operations, including $1,674,000 in service mail pay and $3,239,000 in subsidy. The CAB finds Northwest's breakeven need for period was $3,507,000 and set the new temporary rate at that level, leaving an overpayment of $1,406,000.

During 1954, Pan American received service mail pay of $5,466,000 and $5,936,000 in subsidy for its Pacific operations. Pan American's Pacific Division reported a $4,556,000 profit for the year, a 15.89% return on the carrier's Pacific investment.

The Board finds that Pan American's Pacific breakeven need for 1954 was $5,134,000, an amount covered by the $5,466,000 received in service mail pay. Thus the CAB proposed to put Pan American's Pacific operations on a new temporary mail rate which is the same as the service mail rate for 1954.

The CAB figures that without the $5,936,000 subsidy paid in 1954, but with the $3,087,000 income tax credit related to the subsidy return, Pan American will still have a profit of $1,769,000 for its Pacific operations in 1954, a 6.23% return on investment.

Examiners Choose 31 Irregulars

Washington—Examiners of Civil Aeronautics Board have recommended that 31 of the 54 applicants in the Large Irregular Case be authorized to operate as supplemental air carriers.

The report by examiners Ralph L. Wiser and Richard A. Walsh deals only with the qualifications of the individual applicants and is one of the final steps in the long, complicated case. The CAB made its general policy decision in the case in November 1955.

Judging the qualifications of the applicants, the examiners applied a financial standard which depended heavily upon "going-concern status," evidenced by current operations, although they accepted certain other proof of operational and financial ability.

The examiners also applied a test of "trustworthiness," based upon past violations of regulations, to judge whether applicants can and will obey the Civil Aeronautics Act and CAB regulations.

If the CAB follows its examiners' recommendations, it will leave the two supplemental airline associations at about equal strength. All 11 members of the Independent Military Air Transport Assn. were approved in the report, and 15 members of the Aircoach Transport Assn. received the approval of the examiners.

With these yardsticks, the examiners recommended that the CAB issue supplemental air carrier authority to Airline Transport Carriers, All-American Airways, American Flyers Airline Corp., Artic-Pacific, Argonaut Airways Corp., Associated Air Transport, Aviation Corp. of Seattle, Blatz Airlines, California Eastern Aviation, Capitol Airways, Coastal Cargo, Conner Air Lines and General Airways.

Also favored for supplemental authority were Johnson Flying Service, Los Angeles Air Service, Meteor Air Transport, Miami Airline, Modern Air Transport, Overseas National Airways, Quaker City Airways, Regina Cargo Airlines, Sourdough Air Transport, Southern Air Transport, S. S. W., Inc., Standard Airways, Stewart Air Service, Trans-Caribbean Airways, Transocean Air Lines, U. S. Aircoach, U. S. Overseas Airlines and World Airways.

20 new 420 mph turbo-prop VICKERS VANGUARDS . . .

Ordered by Trans-Canada Air Lines

PURCHASE OF 20 NEW TURBO-PROP VICKERS VANGUARDS—with an option on four more—has just been announced by Mr. Gordon McGregor, President of Trans-Canada Air Lines. Delivery will commence in the Fall of 1960. Explaining his company's action, Mr. McGregor said, "T.C.A.'s decision to order the Vanguard came after the most exhaustive equipment analysis ever undertaken by the company. The evaluation was made over a period of two years during which six other competing aircraft were thoroughly examined."

Noting the outstanding passenger popularity of T.C.A.'s fleet of Vickers Viscounts, Mr. McGregor added, "The Vanguard will have the same freedom from noise and vibration as the Viscount; it will not present any runway length or strength problems. We expect to be able to operate it at remarkably low aircraft mile and seat costs. And we are convinced it will provide the ultimate in passenger appeal and comfort."

TCA'S VANGUARD IS 2-IN-1 AIRLINER! The efficient "*double-deck*" fuselage makes the Vanguard a *full-time* money-maker. Upper deck: 102 passengers. Lower deck: *three times the freight capacity* of any similar plane—can carry the Vanguard's full 24,000-pound payload. Stage lengths up to 2600 miles. Speed over 420 mph.

EXPERIENCE HAS NO SUBSTITUTE! Into each Vanguard will be built over 2-million hours of Viscount flying experience.

turbo-prop VICKERS

VANGUARD

POWERED BY FOUR ROLLS-ROYCE TYNE ENGINES

U.S. Representative: Christopher Clarkson
10 Rockefeller Plaza, New York 20, N. Y.

VICKERS-ARMSTRONGS (AIRCRAFT) LTD., WEYBRIDGE, ENGLAND • MEMBER COMPANY OF THE VICKERS GROUP

SHORTLINES

► **Chicago Helicopter Airways** and Turkish Airlines have been admitted to the International Air Transport Assn., bringing IATA's rolls to a total of 70 active and six associate members. Chicago Helicopter Airways, which started scheduled passenger operation last year, has become an associate member. Turkish Airlines, the successor to Turkish State Airlines, joined IATA as an active member.

► **Airlines Clearing House** handled interline transactions worth $58,006,460 in November, an increase of 19.4% over business transacted the previous November.

► **CINTA Chilean Airlines** has introduced a family fare plan on its twice-a-week flights between Miami and Santiago.

► **Miami International Airport** had an operating profit of almost $2 million in 1956. Gross revenues for the year were $3,067,650; expenses $1,083,530. . . . Airlines are planning to spend about $20 million for new facilities at the Miami Airport.

► **Pan American World Airways** will begin daily service between New York and the Dominican Republic, Haiti and Jamaica on Feb. 1. The new DC-6B service replaces the current schedule of three flights a week to the Dominican Republic and Haiti, and extends the service to Montego Bay, providing a direct connection between New York and Jamaica.

► **Trans-Canada Air Lines** will equip its Viscount fleet with Collins Radio Co. automatic pilot systems. Installation of the autopilots is scheduled to begin in April.

► **Trans World Airlines** reports its domestic passenger traffic in the first week of 1957 gained 27% over the same period of last year; international traffic was up 18% for the same week.

► **United Air Lines** flew 324,403,000 passenger-miles in December, a 10% increase over the previous December. Air freight traffic increased 76% in the same period.

► **Air France** carried 24% more passengers during 1956 than in 1955 for a total of more than 2,280,000. Average system-wide load factor was 71%. Passenger-miles flown rose 20%, mail was up 31%, freight was up 15% over the previous year.

AIRLINE OBSERVER

► Trans-Australia Airlines and Tasman Empire Airways probably will place orders for Vickers Vanguard turboprop transports sometime this year. Trans-Australia, a state-owned airline, will receive government support for the purchase of two Vanguards, but TEAL—which wants four Vanguards—faces financing problems and may turn to the Britannia because of an attractive price offer from Bristol.

► **Northwest Airlines will soon begin construction of a $15 million headquarters and maintenance building at Wold Chamberlain Airport in Minneapolis. New building will house 3,000 employes and be able to handle 15 four-engine aircraft for maintenance at one time.**

► Qantas Empire Airways plans to dispose of six Super Constellations and three DC-4s in late 1958 or early 1959 in hopes of beating the flood of piston-engine aircraft expected to hit the aircraft market once jet transports begin to come off the production line.

► **Pacific Northern Airlines has flown 25 million passenger-miles since it was established without a passenger or crew fatality. The airline will complete 25 years of Alaskan service in April.**

► Air India International has chosen San Francisco over Los Angeles as the terminus for a new transpacific passenger service, which is expected to start late next June or early July. Former commerce manager for India, San Francisco Consulate Jermeja S. Hundal, will be airline's district sales manager.

► **Airlines will meet in Washington on Jan. 28 to review indicator/collision avoidance systems as a result of contract cancellations by Collins Radio Co. (AW Jan. 14, p. 26). If present program, which calls for a non-cooperative electronic system is dropped, airlines may be forced to join a larger program involving a civil/military common system using cooperative equipment in aircraft.**

► Northeast Airlines flight crews will fly as observer-trainees on British Overseas Airways Corp. Britannias between London and South Africa in the opening phase of Northeast's training program. The airline plans to use Bristol facilities in England to train its technical personnel before beginning its own training program.

► **Firm orders for commercial aircraft rose from 219 in December 1955, to 444 in November 1956. Turbojets account for 285 aircraft in the current backlog.**

► Scheduled airlines recorded a slightly improved safety record during 1956 over 1955 despite the United-TWA collision over Grand Canyon on June 30. Passenger fatality rate per 100 million passenger-miles for the entire industry was .53 in 1956 against .65 in 1955. The domestic rate was .64 in 1956 as compared with .79 the previous year. International and territorial airline fatality rate was .09 last year and .04 in 1955.

► **Air Transport Assn. has raised objections to a recent proposal that Hungarian refugees be provided free "space available" transportation by the scheduled airlines. ATA says the frequent off and on-loadings at intermediate stops would cause a disorganized type of service that would be detrimental to the refugee program. The association said other similar requests have been denied in the past to prevent opening the "floodgates" to limitless requests on the same basis. Sen. Hubert Humphrey (D.-Minn.) made the original proposal.**

► Air Line Pilots Assn. will hold its annual Air Safety Forum at the Hotel Shoreland in Chicago March 5-7. This year's forum will concentrate on the "most currently critical air safety problems from an operational viewpoint," and various turboprop and turbojet transport and air traffic control matters will dominate the meeting's agenda, according to ALPA President C. N. Sayen.

SAS

SCANDINAVIAN AIRLINES SYSTEM

INAUGURATES *Global Express* SERVICE

...with TURBO COMPOUND-powered Douglas DC-7Cs

A new era in air travel to Europe is opened up by the new DC-7C "Global Express" of SAS—Scandinavian Airlines System—a service featuring the first and only one-stop flight from Los Angeles to Europe, with other time-saving runs that include New York-Hamburg and New York-Copenhagen non-stop, and through service to leading European cities. For all these flights, including those of its famed polar route from California to the Continent, SAS chooses Douglas DC-7Cs powered by the Curtiss-Wright Turbo Compound® engine.

Today, 41 leading world airlines have selected the Turbo Compound to power the luxury flights, the blue-ribbon, coast-to-coast, continent-to-continent, and over-ocean runs where speed and comfort are the keynotes.

The fastest airliners in service today are powered by this world-famous engine that combines speed, range, dependability and operational economy. With a backlog of more than 23 billion seat miles, and with a perfect safety record, the Turbo Compound has proven its claim to leadership among the world's airline engines. The more than 53 million seat miles now flown daily behind the Turbo Compound will increase to 100 million daily as future schedules take effect.

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World's Finest Aircraft Engines

CURTISS-WRIGHT OF CANADA, MONTREAL • CURTISS-WRIGHT EUROPA, AMSTERDAM

Airline Traffic—November 1956

	Revenue Passengers	Revenue Passenger Miles (000)	Load Factor	U. S. Mail	Express	Freight	Total Revenue Ton-Miles	Per Cent Revenue to Available Ton-Miles
DOMESTIC								
American	619,096	366,169	62 56	1,613,008	938,300	7,357,373	45,934,164	58.10
Braniff	150,872	62,580	58 43	239,119	136,213	326,387	6,698,915	48 68
Capital	265,043	95,038	59 47	291,531	189,148	315,202	9,896,941	46 37
Continental	58,112	21,009	53 73	74,757	25,287	101,706	2,216,443	45 66
Delta	196,651	90,954	56 30	320,766	309,976	671,626	10,041,429	53 33
Eastern	602,955	282,516	57 09	864,771	488,488	1,407,857	32,095,357	45 96
National	103,698	66,980	60 24	264,112	57,021	430,037	7,593,203	61 33
Northeast	43,813	8,824	54 59	10,976	15,568	21,148	867,621	52 44
Northwest	100,647	63,098	54 98	375,342	227,672	722,531	7,651,054	50 63
Trans World	342,122	250,767	54 67	1,067,722	860,438	2,257,115	28,215,014	51 03
United	470,052	310,236	62 68	2,153,765	1,071,073	4,680,454	37,709,435	56 13
Western	99,741	46,281	57 07	246,548	99,420	193,741	4,975,988	52 17
INTERNATIONAL								
American	10,548	7,322	57 41	11,024	352	300,106	1,085,435	61 78
Braniff	2,670	5,793	47 81	32,885	.....	73,948	769,229	53 03
Caribbean Atlantic	14,221	973	61 90	1,258	.....	3,260	91,966	61 00
Delta	4,519	5,081	57 90	6,921	.....	45,203	581,298	47 40
Eastern	18,351	24,695	54 94	67,802	.....	107,081	2,854,147	49 69
National	6,772	3,996	34 78	8,967	4,041	37,594	466,362	41 91
Northwest	7,904	15,396	47 70	1,082,392	25,453	824,116	3,674,340	66 30
Pan American								
Alaska	4,660	6,625	57 75	36,828	.....	278,413	999,238	49 12
Atlantic	65,921	91,877	63 18	1,137,319	.....	2,621,214	13,622,019	64 04
Pacific	24,023	74,957	67 16	1,007,198	.....	1,452,692	10,481,913	62 97
Latin America	87,405	83,586	60 29	375,294	.....	4,337,380	13,011,759	63 56
Panagra	11,536	15,114	62 97	60,460	.....	349,020	2,073,096	63 04
Trans World	15,776	43,609	59 86	853,769	.....	692,404	6,163,251	68 29
United	5,313	13,202	51 21	83,727	.....	56,840	1,504,962	47 90
LOCAL SERVICE								
Allegheny	33,594	5,544	45 24	7,076	19,254	7,527	562,627	46 60
Bonanza	10,926	2,421	45 52	3,730	2,066	5,804	242,593	43 79
Central	8,166	1,633	32 71	3,847	2,458	5,208	167,902	29 43
Frontier	15,530	4,196	45 57	16,575	7,374	51,628	476,446	54 55
Lake Central	11,981	1,946	47 54	2,485	15,876	458	199,591	42 78
Mohawk	33,907	6,203	56 52	5,165	10,919	9,743	619,148	56 42
North Central	41,682	6,446	49 25	16,231	33,086	.....	660,888	44 18
Ozark	27,806	4,314	39 53	10,246	18,172	7,716	439,453	40 84
Piedmont	33,072	6,175	51 54	12,342	16,172	11,751	631,555	51 73
Southern	16,921	3,022	46 51	7,972	11,551	.....	308,667	43 85
Southwest	27,136	5,975	55 14	8,728	5,517	7,430	590,614	53 27
Trans Texas	19,339	4,382	39 14	12,884	9,839	20,929	461,308	36 05
West Coast	15,035	2,735	42 53	3,554	2,202	3,026	262,588	50 20
HAWAIIAN								
Hawaiian	29,966	4,095	55 61	3,836	.....	94,933	456,694	54 98
Trans Pacific	12,568	1,526	50 66	918	.....	10,650	132,667	51 87
CARGO LINES								
Aerovias Sud Americana	.....	.....	.....	.....	.....	751,038	751,038	68 87
Flying Tiger	5,851	19,543,000	99 08	28,595	42,318	5,647,587	7,672,779	79 87
Slick	2,014	8,653	95 30	82,513	129,203	6,884,922	7,961,982	75.01
Riddle*	.....	.....	.....	.....	.....	.....	.....	.....
Seaboard & Western	5,449	21,125	100 00	.....	.....	1,581,245	3,693,750	79.00
HELICOPTER								
New York Airways	4,819	92	34 33	1,242	1,210	755	11,749	38 77
Los Angeles Airways	2,027	73	39 24	4,362	1,941	.....	13,205	37 50
Chicago Helicopter	429	6	24 70	2,082	.....	.....	2,727	26 81
ALASKA								
Alaska Airlines	5,296	1,864	33 43	49,855	.....	399,858	660,825	50 20
Alaska Coast	2,660	235	63 51	4,158	.....	3,677	32,090	67 36
Cordova	1,002	209	44 56	3,223	.....	13,067	37,803	45 12
Ellis Air Lines	3,568	181	57 64	1,630	.....	2,407	22,449	71 55
Northern Consolidated	2,557	536	48 11	25,806	433	253,022	338,535	82 08
Pacific Northern	7,278	5,270	40 75	67,953	.....	286,639	925,348	53 85
Reeve Aleutian	330	203	53 14	17,752	.....	20,654	60,593	73 59
Wien Alaska	2,594	1,091	20 43	35,431	.....	510,915	659,647	92 11

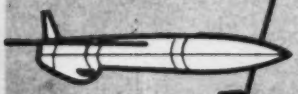
* Not Available.

Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

SUNDSTRAND

First in Constant Speed Drives . .

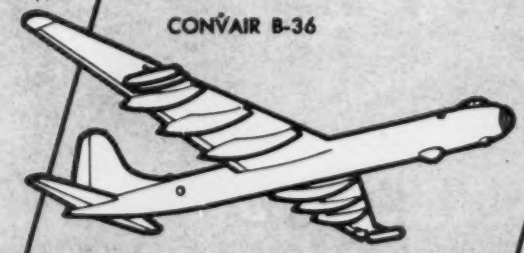
McDONNELL F3H



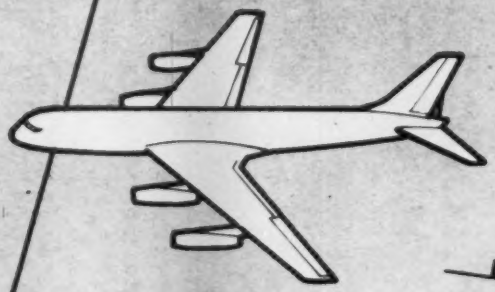
NORTHROP SNARK

BOEING 707

MARTIN P6M

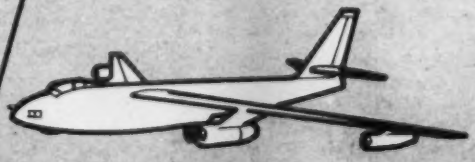


CONVAIR B-36



DOUGLAS DC-8

NORTH AMERICAN F-100D

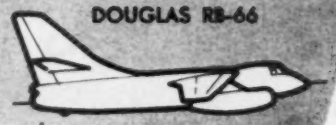


BOEING B-47E

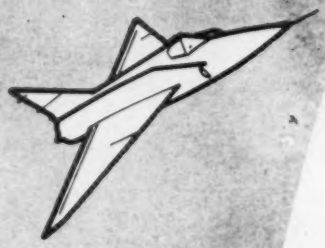
MARTIN P5M

McDONNELL F-101

DOUGLAS RB-66

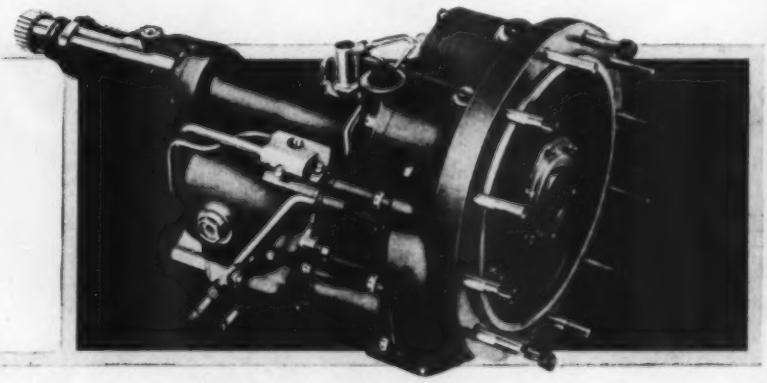


CONVAIR F-102A



Over 10,000 SUNDSTRAND DRIVES have logged millions of flight hours setting records for reliability and performance

These are the aircraft on which over 10,000 Sundstrand Drives have logged millions of flight hours. Further evidence of industry acceptance are the two new jet airliners which will soon be adding to the Sundstrand Drive's record for reliability. A record built on ten years' experience and encompassing applications to every major type of aircraft. A record covering over 20 models, backed up by service throughout the free world. At the same time this record for reliability was being built, the Sundstrand Drive set the industry standards for constant speed drive performance—frequency control to $\pm$ 1/10% and the first automatically paralleled system are just two examples. *Reliability* and *performance* have made Sundstrand *first* in constant speed drives.



WIDE RANGE OF MODELS

Applied to Piston, Turbojet, and Turboprop Engines. The "Package-Type" unit at right is designed to fit into a jet engine nose-cone. Other Sundstrand drives are also custom-engineered to fit your space, weight and kva requirements.

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Division of Sundstrand Machine Tool Company

Rockford, Illinois

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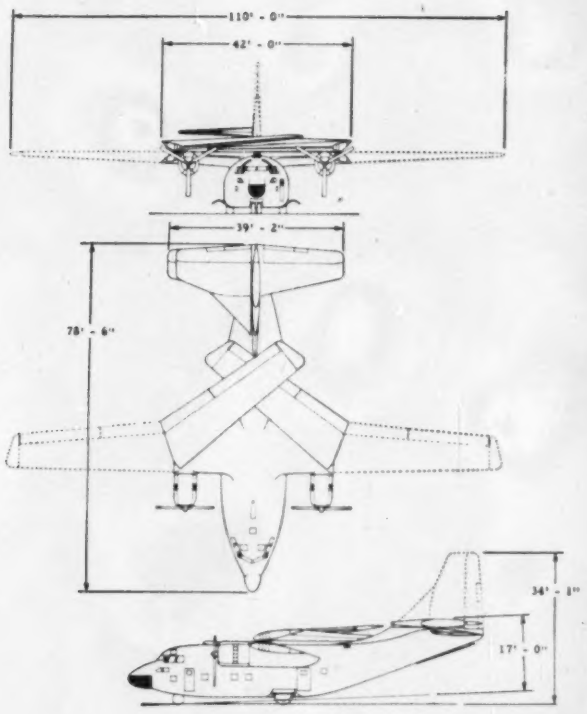
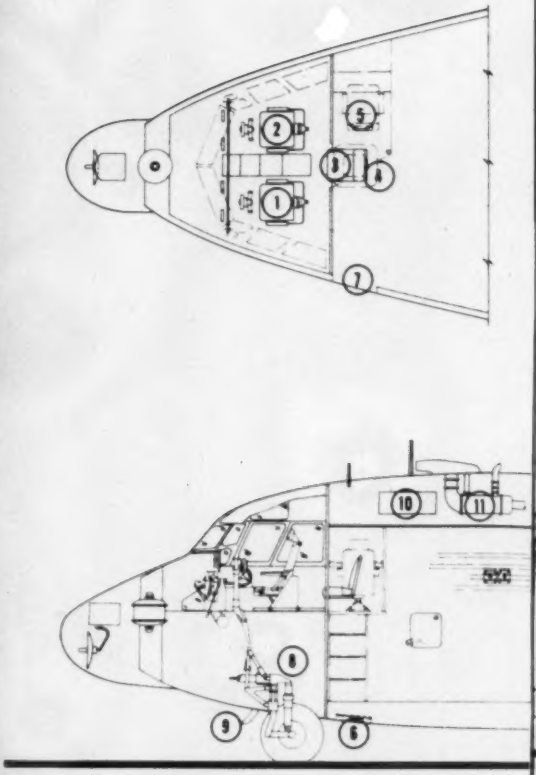
CONSTANT SPEED DRIVES • AIRCRAFT ACCESSORIES





MODIFICATIONS of C-123 for shipboard use include folding wings to cut width from 110 to 42 ft., fin from 34 ft. to height of 17 ft.

Navy Considers C-123 for Aerial Resupply

By Claude Witze

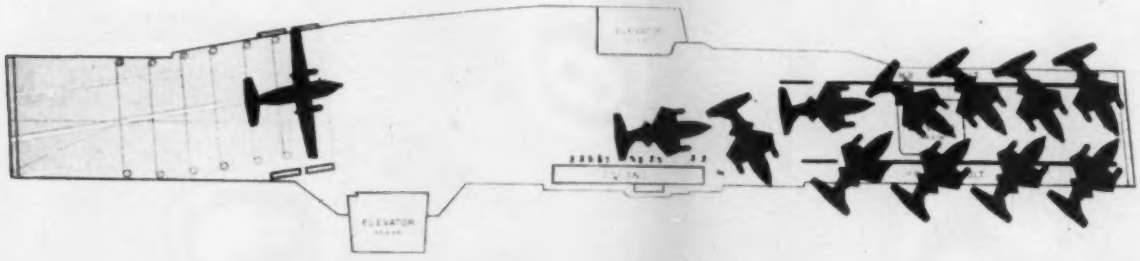
Washington—U. S. Navy is considering a proposal of Fairchild Aircraft Division to adapt the C-123 assault transport for aerial resupply of carrier task groups at sea.

Fairchild has suggested extensive modification of the USAF twin-engine aircraft to provide it with folding wings, folding tail, arresting hook, catapult hook and jet thrust augmentation. The thrust would come from Fairchild J44 turbojet units installed in each nacelle along with the regular Pratt & Whitney R-2800 reciprocating engine.

Thus equipped, the Fairchild study shows that the C-123 would be capable of operating from the deck of Essex class carriers. Grossing approximately 65,000 lb., the aircraft would be able to land, unload and refuel in about 10 minutes. The Essex class carrier will hold 12 C-123s at a time, a figure that will be increased for service on Midway or Forrestal class carriers. The canted deck is essential.

No New Facilities

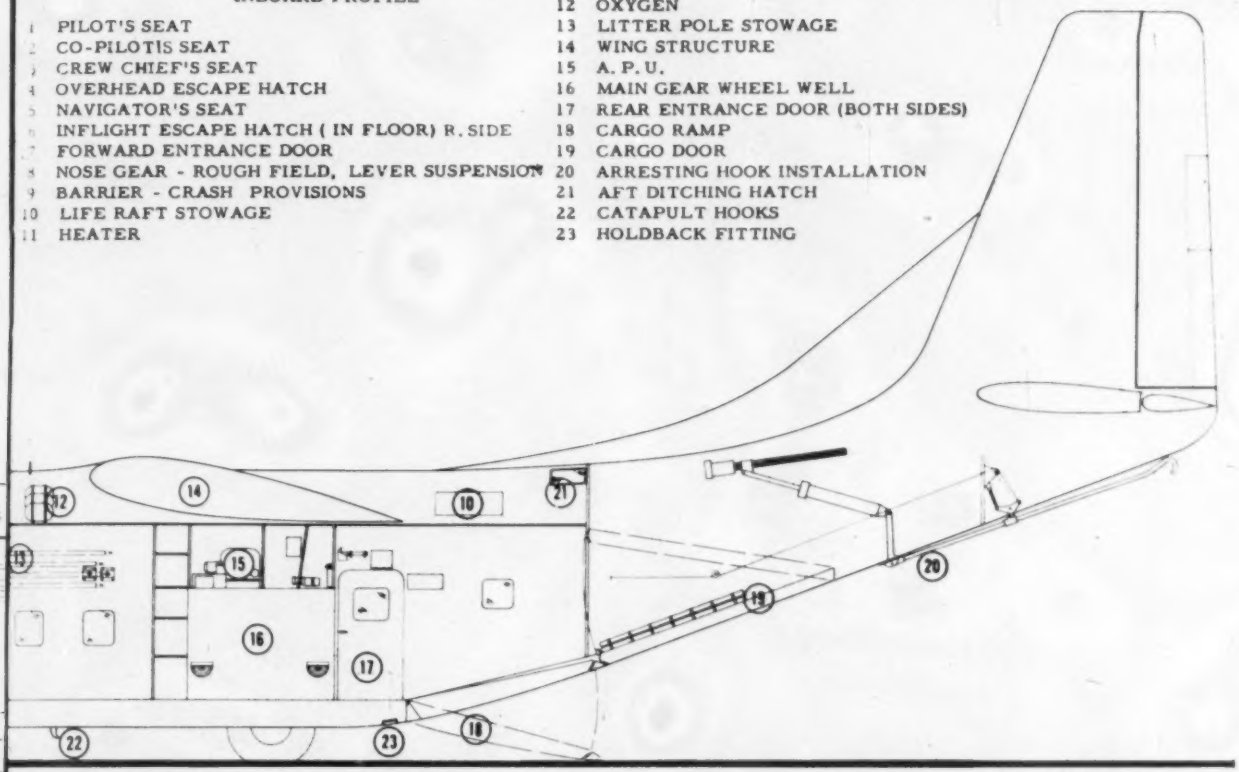
Assuming that the C-123 can easily operate over a radius of 1,500 mi., the report demonstrates that it could carry supplies to a task force anywhere in the Northern Hemisphere from 16 existing U. S. land bases (see map on page 53). It follows that the aerial



ELEVEN C-123s, wings folded, are parked on forward deck as another comes aboard during landing operations.

INBOARD PROFILE

1 PILOT'S SEAT
2 CO-PILOTIS SEAT
3 CREW CHIEF'S SEAT
4 OVERHEAD ESCAPE HATCH
5 NAVIGATOR'S SEAT
6 INFLIGHT ESCAPE HATCH (IN FLOOR) R. SIDE
7 FORWARD ENTRANCE DOOR
8 NOSE GEAR - ROUGH FIELD, LEVER SUSPENSION
9 BARRIER - CRASH PROVISIONS
10 LIFE RAFT STOWAGE
11 HEATER
12 OXYGEN
13 LITTER POLE STOWAGE
14 WING STRUCTURE
15 A. P. U.
16 MAIN GEAR WHEEL WELL
17 REAR ENTRANCE DOOR (BOTH SIDES)
18 CARGO RAMP
19 CARGO DOOR
20 ARRESTING HOOK INSTALLATION
21 AFT DITCHING HATCH
22 CATAPULT HOOKS
23 HOLDBACK FITTING



INTERIOR cutaway shows tail hook mechanism, nosewheel barrier crash guard, catapult hooks. Top view of cockpit is above.

# of Carriers

resupply concept could be used in this area without any important investments in real estate or airport facilities.

The Fairchild aerial resupply concept naturally is based upon the second assumption that the task force will be able to maintain air superiority despite the fact that it might be within striking range of enemy land-based aircraft.

In this connection, it is most important that the time element as envisaged by Fairchild engineers will permit 12 or more C-123s to land, unload and refuel while the carrier's combat planes are in the air on a strike or fleet-protective mission.

As worked out in theory, only one of the four carriers in a task force would be cleared for the resupply exercise. This would leave the other three carriers with room to take aboard any fighter pilot calling for emergency deck space.

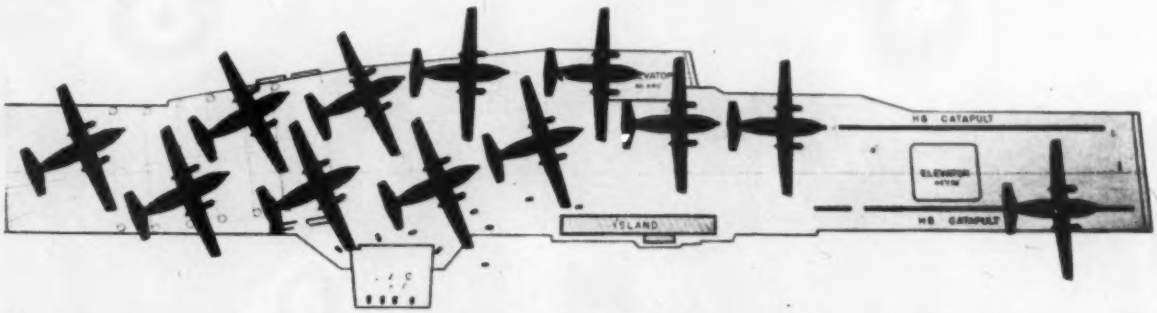
Advantages of Plan

The Fairchild report, presented to the Pentagon last week, claims these various other advantages for aerial resupply:

- **Regular and frequent replenishment** of priority items, most important to the success of the mission.
- **Prompt resupply** of urgent items in case of emergency.
- **Sharp reduction in requirement** for a large inventory of routine supplies aboard ship.
- **Speedy resupply, inside combat** zone if necessary, cuts losses in combat time due to retirement required for surface resupply.

Aerial resupply will not interfere with combat operations.

- **Reduction of the task force's** vulnerability to enemy attack during surface resupply exercises. This applies particu-



AFTER unloading, C-123s are respotted. First plane is catapulted as the others, wings unfolded and engines started, await their turn.

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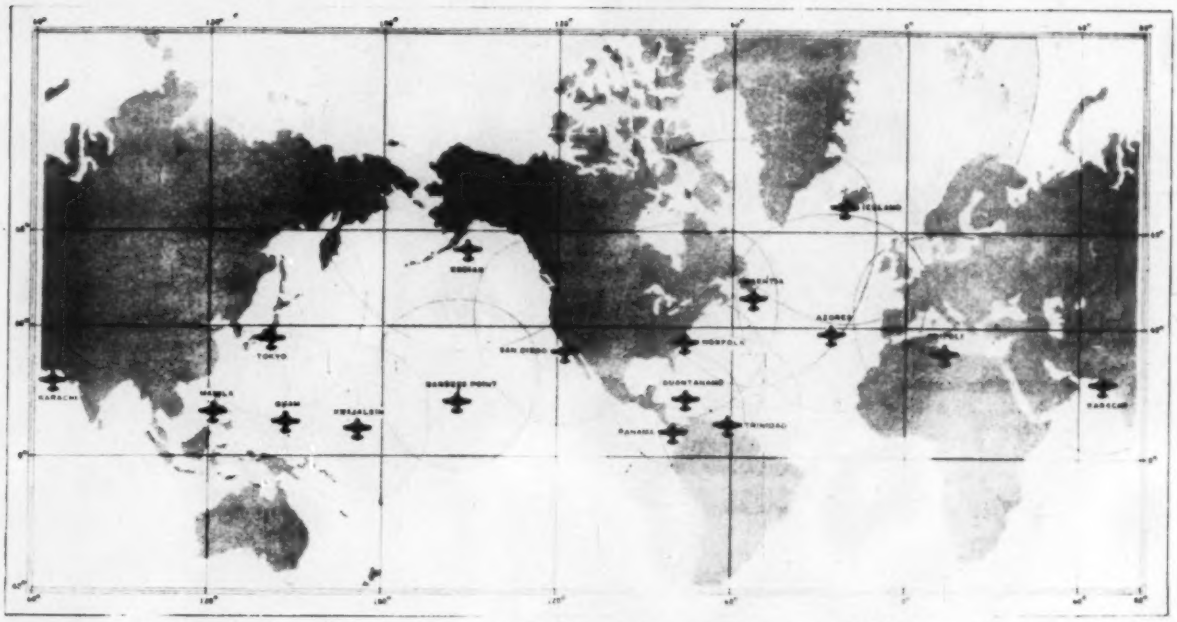


C-123s operating from these sixteen existing bases could resupply task forces anywhere in the shaded areas. The base at Karachi is shown twice—at the extreme left and at the extreme right.

larly to the choice target characteristics of a surface resupply operation if it is under fire from enemy aircraft or submarines.

- **Reduction in requirement** for warehouse and logistic pipeline inventories.
- **Reduction in number of personnel** required to handle surface ships at sea, eliminating specialists for surface resupply activities.

Floating Warehouse Plan

At the initial stages, the Fairchild proposal would have the C-123 resupply the task force carriers directly, feeding them one at a time in order to maintain combat capability during the operation.

A later perfection of the plan would add a fifth carrier to the force, a CVS or floating warehouse. From this ship—where all supplies would be unloaded from the aircraft—goods would be distributed to destroyers, cruisers, carriers, command ships and submarines by helicopter.

The helicopters would be equipped with nets carried on external slings. Supplies could be prepackaged and loaded on pallets. The pallets, equipped with roller wheels, could be pushed in and out of the aircraft with ease and remain loaded for storage aboard the CVS or for movement to another ship in the force.

At the outset, Fairchild engineers say all supplies except POL (petroleum, oil, lubricants) could be fed to the task force by carrier-fitted C-123s. In a new era of atomic-powered fleets, they maintain, even this requirement will disappear and a complete airborne resupply operation will be possible. Presumably, an atomic-powered carrier will be able to carry enough airplane fuel for an extended mission.

The carriers will have to carry gasoline and equipment to refuel the C-123s, but this is not expected to add substantially to the surface-borne fuel resupply problem. Present tankers provide sufficient overage to take care of the additional gasoline burden.

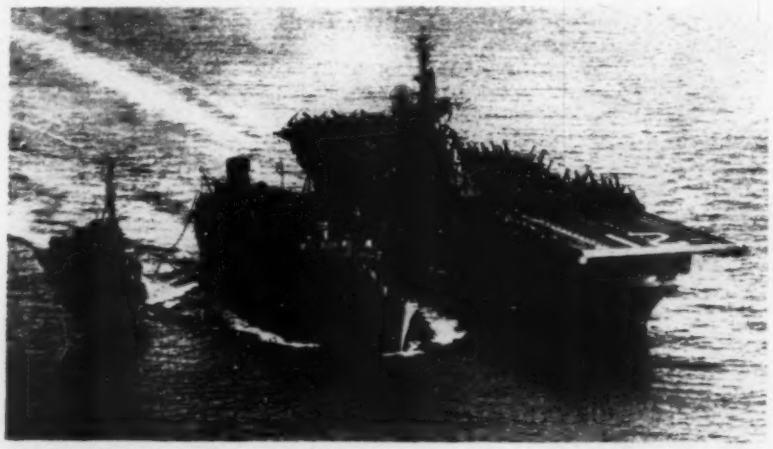
Landing Gear Redesign

Modification of the present USAF C-123 must include redesign of the landing gear to take the tough punishment inflicted by carrier landings. Additional navigational radar also must be included for overwater flight. A seat for the navigator will be added in addition to one for the crew chief.

More than a year ago, Fairchild experimented with a C-123 that had a J44 turbojet engine installed on each wingtip to supply 2,000 lb. thrust. Results of the augmentation test were good and showed that the rate of climb could be increased from 150 to 500 feet a minute.

On the carrier version of the C-123, it will be necessary to dispense with engines on the wingtips and fuel pylons because of the folding wing. For this reason, the J44s will go into the regular engine nacelle.

The J44 in this position will require less corrective action by the pilot if he is forced to use it in event of a reciprocating engine failure. Wave-off capability will be good, Fairchild says, and the plane will be able to make a second



CONVENTIONAL resupply (here refueling) at sea is vulnerable to attack.

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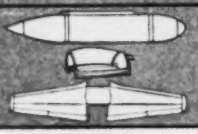	TANK-WING-MAJOR SUBASSEMBLY SUBCONTRACT PRODUCTION

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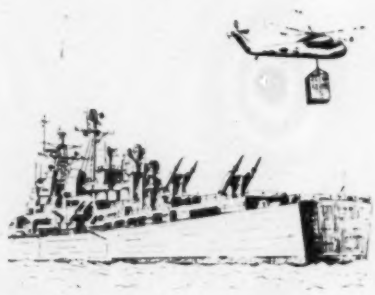
HELICOPTER using cargo net, leaves carrier.



HELICOPTER using sling, supplies cruiser.

approach with ease, even with one engine not operating.

Provision of the folding wings and tail, to permit the C-123 to be lowered on an Essex class carrier elevator is considered necessary only for cases of emergency.

A C-123 in need of maintenance, with an engine out or a flat tire, would immobilize the deck.

This feature also will facilitate ferrying of aerial resupply planes by carrier to distant land bases.

'No Cost' Study

Fairchild's proposal is a "no cost" study, prepared with Navy approval but without a contract. The company has suggested that the Navy contract for an evaluation of the idea with a current C-123 equipped with the additional J44 engines.

It has argued that the proposal would give the Navy a new aircraft at minimum cost, promising increased strike potential for a task force along with economies in ships, personnel, inventory and fleet vulnerability.

On top of this, the Marine Corps is known to be interested in the C-123 for assault transport missions. In this activity, it would supplement transport helicopters in Marine vertical envelopment tactics.

The Fairchild company is expected to make another proposal incorporating these ideas.

Thor Test, Assembly Facility Is Planned

Test and assembly facilities for the Douglas Thor intermediate range ballistic missile are being planned on a 1,700 acre site adjoining the Aerojet-General rocket test grounds near Nimbus, Calif. in the Sacramento area. Over $4 million will be spent on the site in 1957.

USAF awarded the company a contract for $1,305,500 to build guided missile program support facilities. F. W. Conant, senior vice president, said the company would spend as much as $3 million of its own money on the project.

The money will be spent on land clearance and construction of roads, missile test stands, assembly and modification hangars, a cafeteria, a fire and plant protection building and a control building.

Contracts totaling more than $2 million have already been awarded to A. Teichert and Sons, Sacramento; Baldwin Construction Co., Marysville; George A. Fuller Co., Los Angeles; Consolidated Western Steel Co. and the American Bridge Co.

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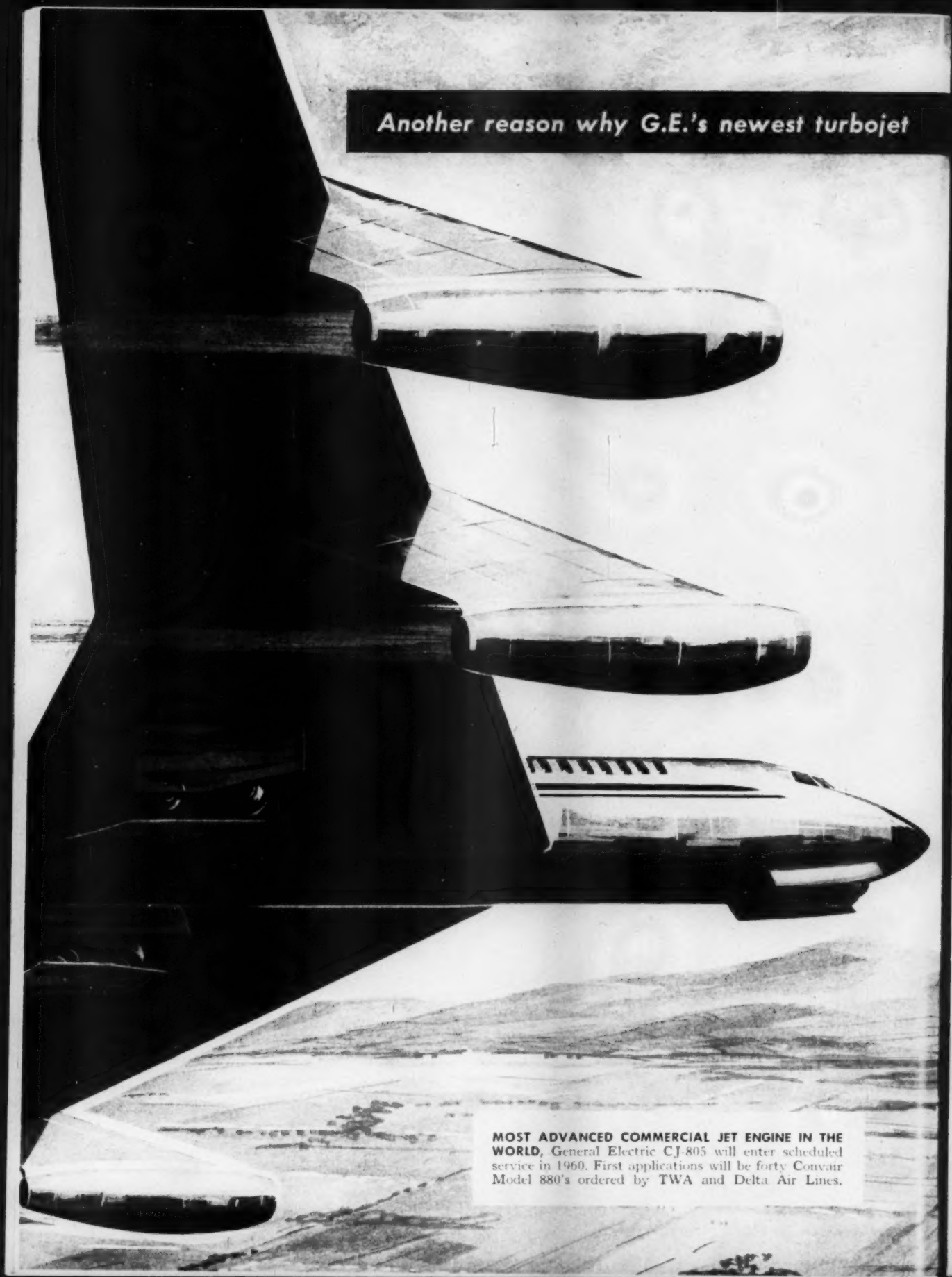
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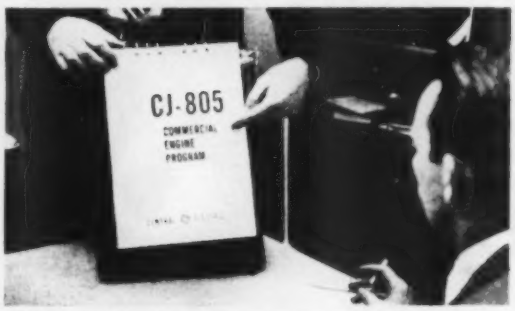
3. Optimum engine operating temperature—As rated for airline operation, the CJ-805 has a turbine inlet temperature below that of the J79. This maximizes component life, yet offers high thrust at lowest engine weight.

For further details on the CJ-805, contact your G-E Aircraft Engine Specialist. You can reach him via your nearest G-E Aviation & Defense Industries Sales Office. *General Electric Company, Cincinnati 15, Ohio.* 237-6

CONTINUOUS G-E RESEARCH—for example, studies on "tailor-made" alloys—have paid off on new CJ-805. To develop and produce new engines, G.E. has invested in facilities with replacement value of $100,000,000.



MORE FACTS ON GENERAL ELECTRIC CJ-805 and the benefits it offers medium-range jets are contained in this flip-chart, available to qualified airlines. Contact G-E Aircraft Engine Specialist to arrange presentation.

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Today all engineering recruiting advertisements talk of opportunity, yet most are, in spite of the most sincere intentions of the company seeking applicants, necessarily restricted to the offer of a chance to pursue substantially the same duties on another payroll. Moving to a new position may offer certain superficial advantages but the basic opportunity for long range growth may be restricted by the same factors which have limited advancement on the applicant's former job. We believe that we can offer an opportunity for analog computer operations engineers to utilize fully their previous experience in an area which offers broader responsibilities with commensurate increase in salary.

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Staff Analog Computer Engineers (particularly those with aeronautical experience) are singularly qualified to accept major responsibilities in this area. The computer expert who fills this position will direct his efforts along the lines of product development and design on multi-million dollar projects; such an effort offers opportunities for advancement to upper management levels which are, we believe, denied most engineers working in a computer staff group. It should be recognized that by participating in this effort, an engineer is actively engaged in the direct support of our principal source of revenue rather than acting in an indirect supporting capacity with attendant lessening of overall responsibility. Lack of electronic design experience or the absence of a profound understanding of specialized electronic theory at a professional level should not be an appreciable handicap to the man who fills this position, as his efforts will be well-supported by an established team of electronic experts in our Research and Development organization.

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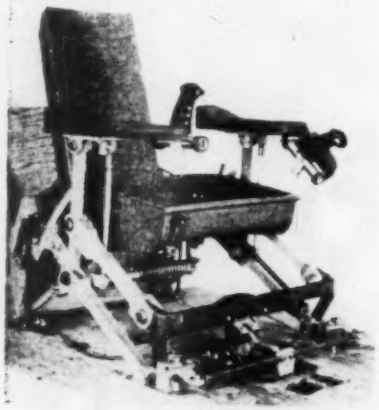
Volunteers Breathe Ozone Mix for Test

A scientist and four volunteer airmen from the Air Force School of Aviation Medicine have subjected themselves to controlled concentrations of deadly ozone to learn how big a dose the human pilot can survive.

Ozone is a more powerful oxidizer than its relative, gaseous oxygen, and is present in lethal quantities in the ionosphere now being approached by high performance aircraft.

Dr. Hans-Georg Clamann, breathed an ozone concentration of eight parts per million for one hour in a chamber at the Armour Research Institute of Illinois Institute of Technology. "My lungs began to fill with fluid and my breathing capacity was cut down to about 50%," Clamann reported to fellow scientists. Results indicate that in sensitive persons, concentrations as low as two ppm. may cause severe lung irritation in less than an hour. Men proved to be more sensitive to ozone than laboratory animals. The study was



Armrest Control

Control stick is replaced in a T-28 rear cockpit test installation by composite flight control in which ailerons and elevators are operated by moving armrests. The mechanically linked system compensates for a wide range of longitudinal and vertical adjustments. It was designed to minimize modification of the T-28 and permit stick control to be restored without loss of serviceability. Elevator is controlled by fore and aft movement of both armrests and aileron is controlled by differential movement. Standard pedals are used for rudder control. The pilot's seat was completely redesigned to provide clearance for the rearward motion of the armrest and for column and linkage space between seat and consoles. A lockout system enables the safety pilot in the front seat to override the experimental controls. Unit was designed by C. O. Noville & Associates, Inc. under USAF contract.

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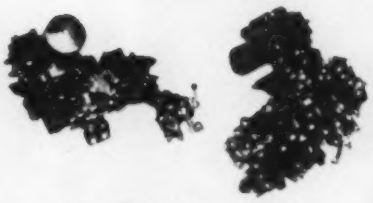
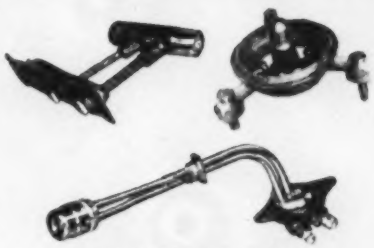
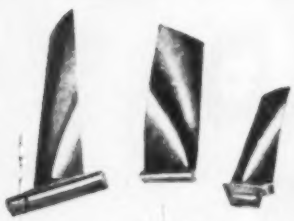


FUEL CONTROL AND METERING ASSEMBLIES

HYDRAULIC & PNEUMATIC ACTUATOR ASSEMBLIES



FUEL NOZZLES FOR JET ENGINES



JET ENGINE BLADES

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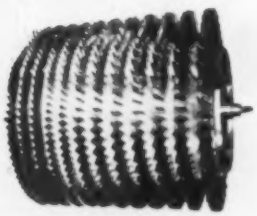

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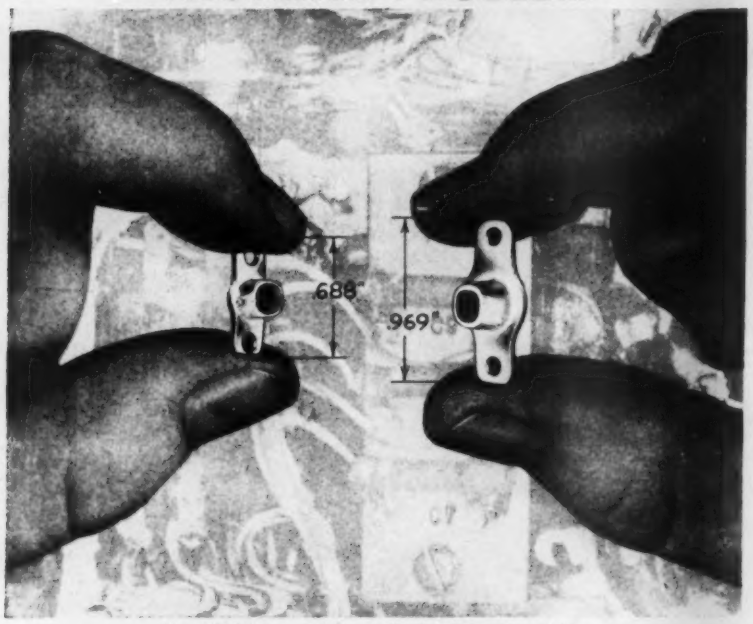

New LHTA1M nut on left, standard anchor nut on right.

"SPACE-SAVER" anchor nuts needed for avionic applications

Shrinking space allowables and the urgency of eliminating every possible pound of weight, are problems that continuously confront electronic and avionic design engineers. The "black boxes" for radio, radar and missile guidance systems are under constant scrutiny for miniaturization . . . and fasteners too, are affected. One of the most urgent needs was for a tiny "fixed" anchor nut for attachment of interior components. Lowest possible weight and size were required; the ability to withstand temperatures in the area of 500° F. was desirable.

Type LHTA1M is ESNA's answer. Over-all length of .688" compares to .969" for a standard 10-32 size AN366 locknut. Weight is only .17 lbs. per 100 pieces compared to .81 lbs. These space saving "fixed" nuts meet the same tensile and vibration requirements as the standard sized nut and will withstand temperatures up to 550° F. Like all self-locking Elastic Stop® nuts they are dependably self-locking and are guaranteed for extended re-use. Sizes 4-40 thru ¼-28 steel, cadmium plated. Space-savers are also available in one-lug and corner-mounting anchor nut shapes.

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Please send me the following free fastening information:

☐ Bulletin on Miniature Anchor Nut.

☐ Here is a drawing of our product. What self-locking fastener would you suggest?

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a continuation of one conducted on mice.

Clamann reported, "The impact of ozone on man, as on animals, is directed on the soft tissue of the respiratory tract. Beginning at the throat, longer exposure times and higher concentrations tend to carry the injury to the tissue deeper in the lungs."

Swelling of the lung tissue seems to begin at concentrations of 4 or 5 ppm. at exposure times of about an hour. The safety level for workers subjected to ozone produced by industrial operations has been set at 0.1 ppm.

Among other effects reported by Clamann was an impairment in the sense of smell. For the sense of smell test, three solutions were prepared. One was a blank, one produced a pleasant smell and one produced an unpleasant smell. As the test progressed, the subjects lost the ability to identify the solutions. This effect might be turned to good use as an indicator of dangerous concentrations.

"Symptoms, such as burning in the throat, feeling of oppression of the chest, and difficulty in breathing were subject to a large individual variety," Clamann said. No burning of the eyes was observed and no effect could be found on blood pressure, pulse rate, or blood chemistry.

Japan Sells Radar Detector to India

Tokyo—Japan will sell a radar storm detector to India for installation at the International Airport in Calcutta. Called the NMD-451, the radar set has proved to be highly effective in tests at the Meteorological Research Institutes in Tokyo and Osaka.

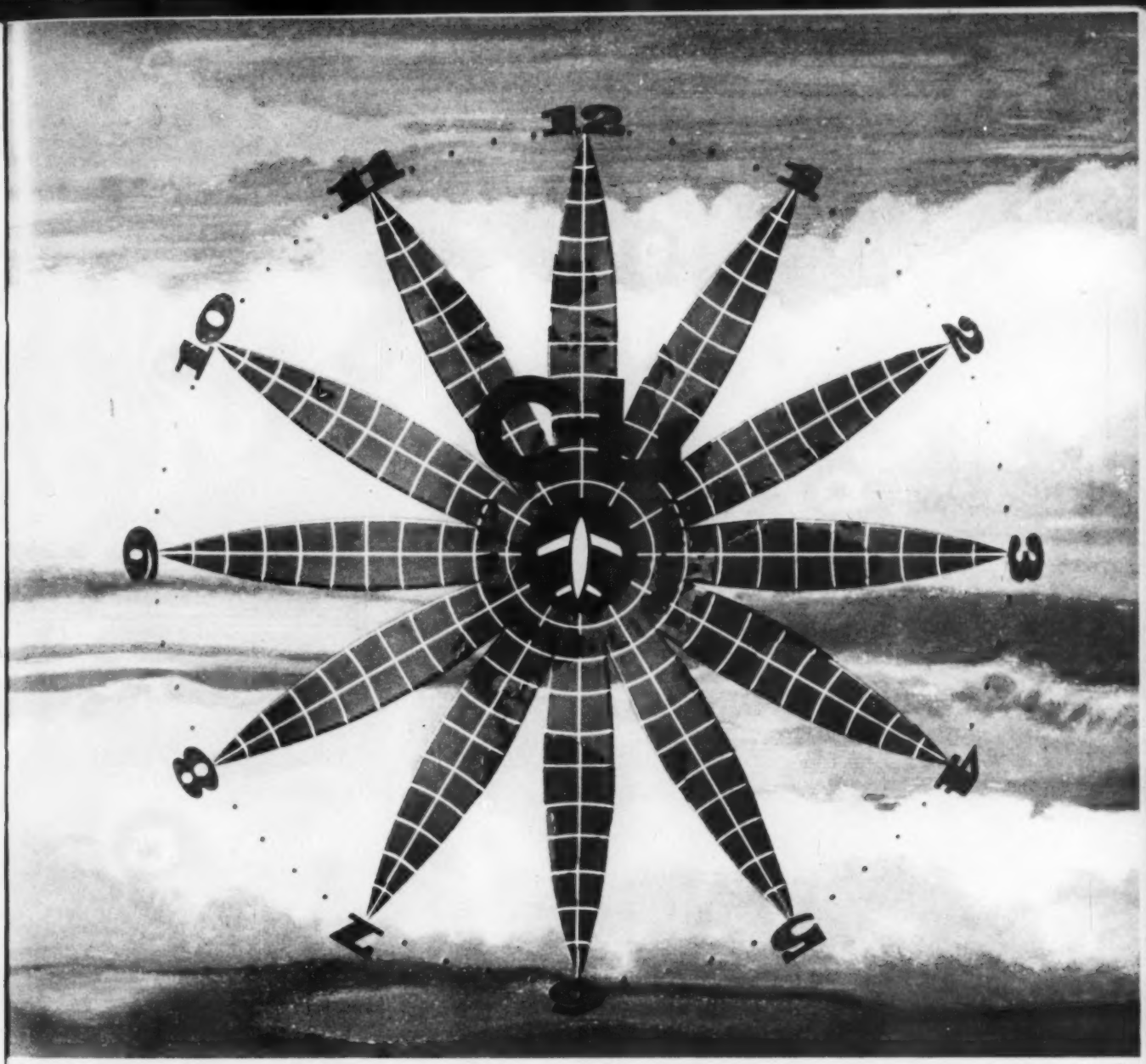
The model costs several times more than the English sets used in India up to now, one feature consists of range-height finders which enable it to measure the altitude of cloud formations.

It has a maximum power output of 200 kilowatts and a wave range that covers a radius of 300 kilometers. The maker is the Japan Wireless Company.

GE Missile Unit Laboratory Formed

An Acrosciences Laboratory has been formed within the structure of General Electric's Missile and Ordnance Systems Department to conduct or direct applied research in specific fields of technology.

Manager of the laboratory is Dr. Leo Steg, formerly manager of advanced reentry systems engineering for GE. Steg also taught graduate courses at Cornell University and was a consultant to



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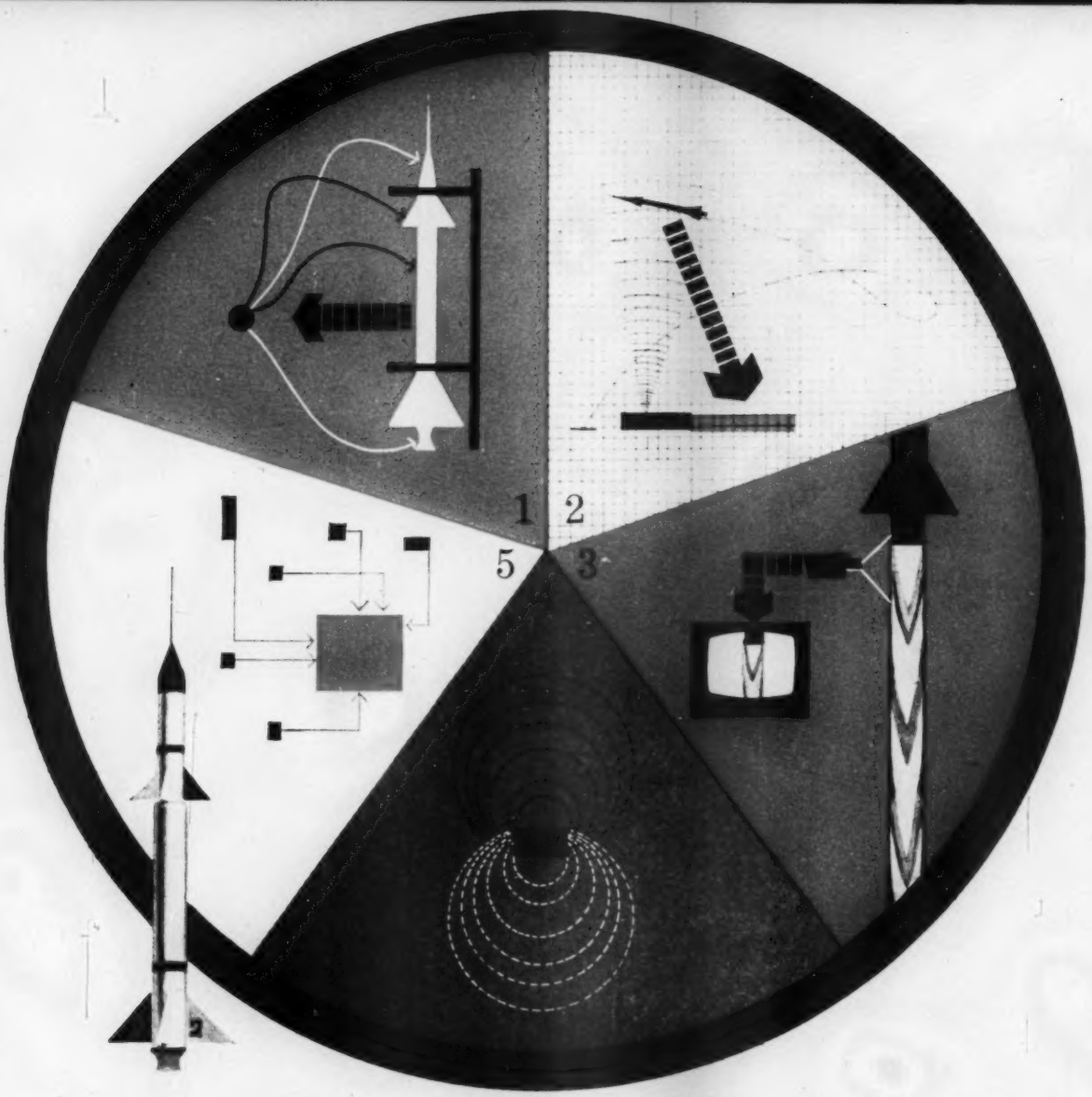

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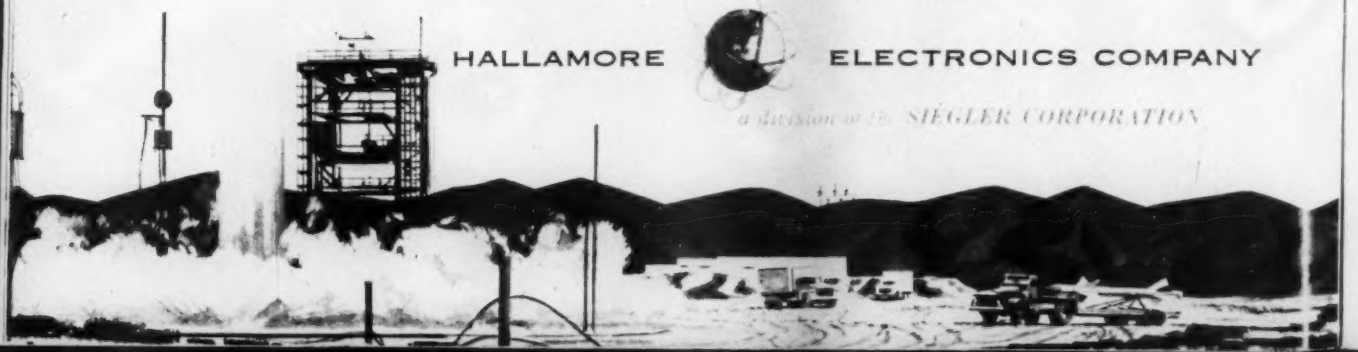

Project Lincoln at MIT and to the Ramo-Wooldridge Corp.

The laboratory expects to complete its test facilities in 1957, including what the company described as the world's most modern shock tunnel, shock tubes, a solar furnace and other equipment.

Mission of the laboratory is to extend the knowledge of hypersonics, aeroballistics, aerothermodynamics and other fields into unknown technological areas.

Hoff Appointed Head Of Stanford School

Palo Alto, Calif.—Nicholas J. Hoff, head of the aeronautical engineering department at Polytechnic Institute of Brooklyn, has been appointed to the faculty of Stanford University. He will be a professor and executive head of the university's newly autonomous Division of Aeronautical Engineering.

The study formerly was included in the Department of Mechanical Engineering. Hoff, a leading researcher in aeronautical structures, served as chief of airplane structures at the Manfred Weiss works in Budapest before World War II. He holds a Ph.D. degree from Stanford.

Talco Buys Stock Of Falcon Aviation

Hamden, Conn.—Talco Engineering Co. of Hamden, Conn., has purchased stock of Falcon Aviation Corp. and taken over lease of a hangar, runways, and other buildings of Falcon Field from the city of Mesa, Ariz.

F. G. Talley, Talco president, said the firm will use the facility for testing ejection seats for jet airplanes. The company manufactures the seats for the Air Force through the Convair Division of General Dynamics Corp.

AiResearch Builds New Phoenix Facility

Phoenix, Ariz.—AiResearch Manufacturing Co., Arizona Division of the Garrett Corp., will expand at Phoenix to include an initial 40,000-sq. ft. building to house 400 workers at a cost of $600,000.

The unit will be alongside the AiResearch test facility and manufacturing plant already in operation. The new unit will accommodate the firm's growing valve and electronic business.

Murray Gelber, manager of the Arizona Division for Garrett, said "as a result of this additional space, our turbo-machinery departments will be able to expand within existing manufacturing areas."

Farnsworth
HAS THE ANSWER

...before the button is pushed

Four... three... two... one... Fire! a tense finger pushes a button.

WHOOSH... and a fiery missile unerringly heads for its target. It worked!

Of course, it *had* to work. In atomic warfare there's no second chance. Farnsworth, a division of International Telephone and Telegraph Corporation, developed the uncanny electronic test equipment that knows—*before* the button is pushed. This not only avoids costly mis-fires or missed targets—it actually safeguards our very lives.

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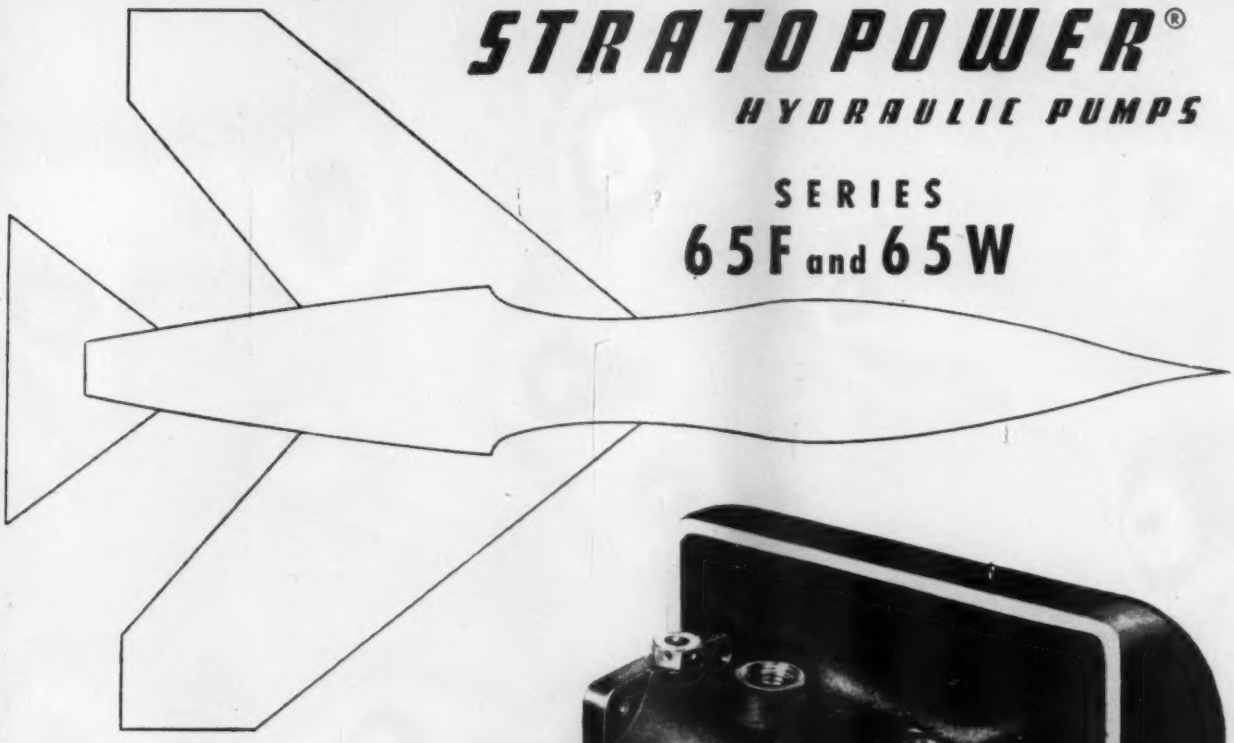
SERIES 65F and 65W



Right—65W Series Variable Delivery Pumps—.25 to 10 gpm at 1500 rpm. Pressures to 3000 psi.

Below—65F Series Constant Delivery Pumps—.5 to 3.0 gpm at 1500 rpm. Speeds to 10,000 rpm and over. Pressures to 3000 psi.

From the first concept, through the prototype and on into production, STRATOPOWER Hydraulic Pumps belong in the forefront in the development of guided missiles and jet aircraft. The higher the accent on reliability, the more important becomes the jewel-like precision, greater compactness and light weight of Series 65F and 65W Pumps to soundly meet your requirements. Get all the facts on new developments in high speed, high temperature STRATOPOWER Pumps . . . write today to Dept. 720A.

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THE NEW YORK AIR BRAKE COMPANY

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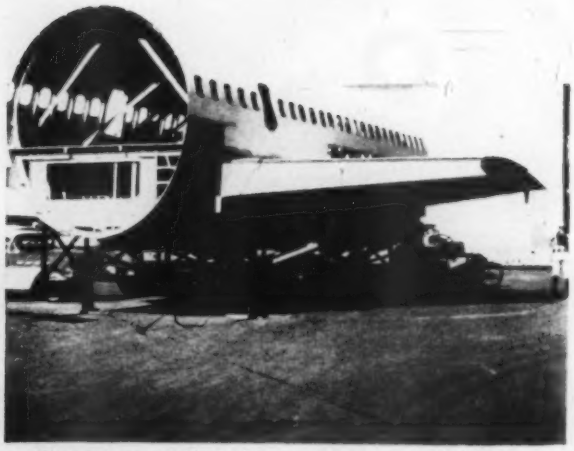
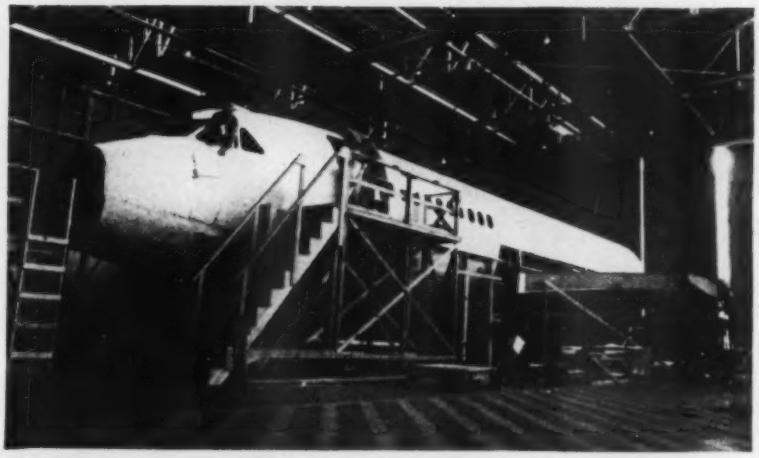
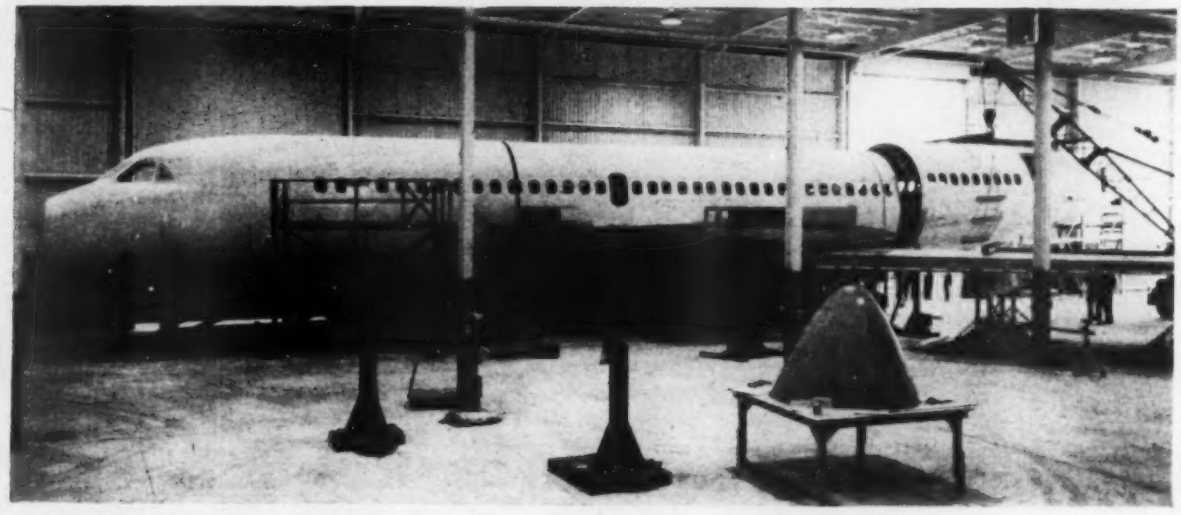


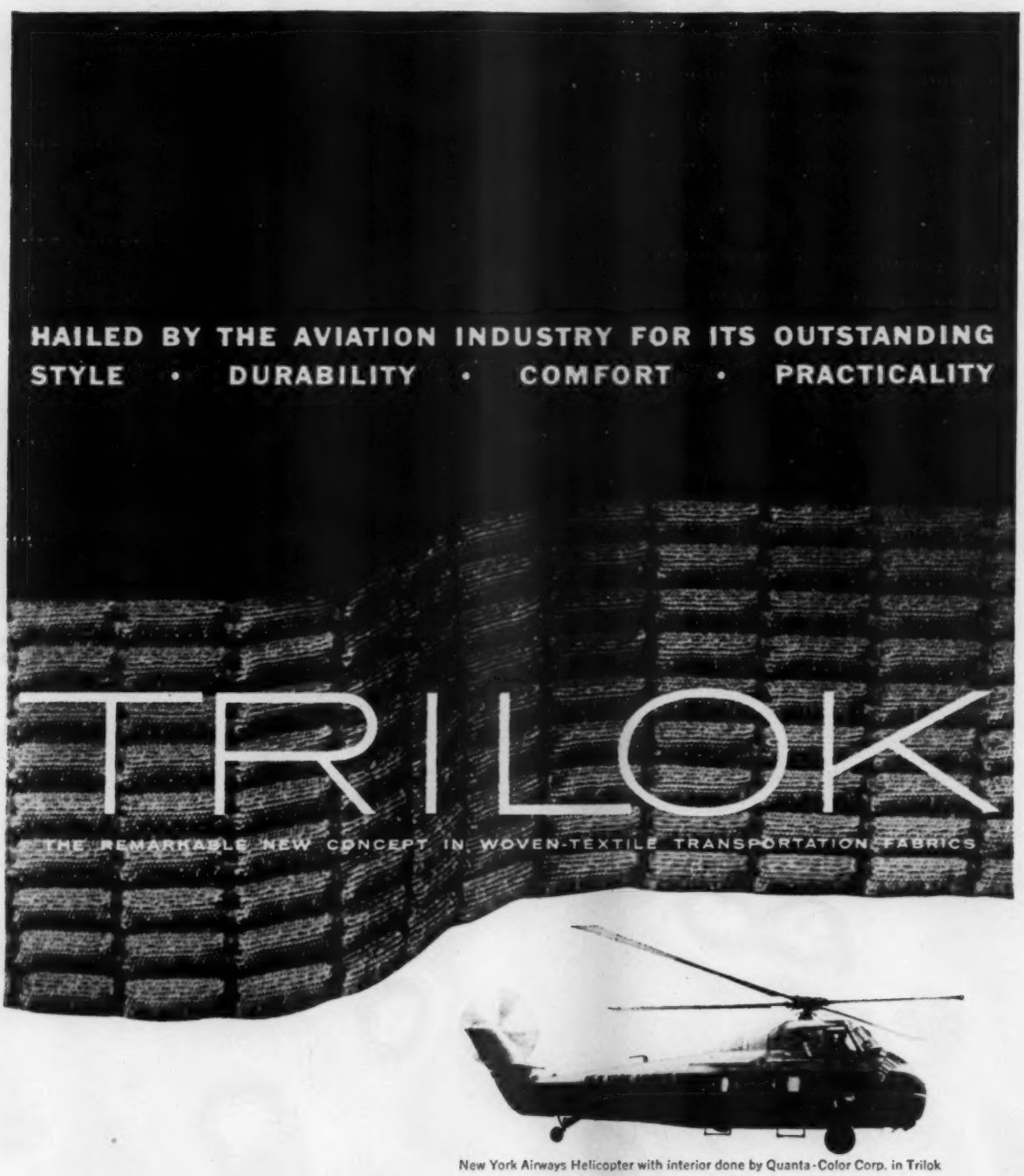
NOSE SECTION (left) and mid-fuselage and wing root section (right) were fabricated separately at Plant 1 at San Diego, Calif.

Convair Assembles Wood 880 Mockup

Wooden mockup of Convair's 880 four-engine jet transport was built in sections in one building (right), moved in sections (above) to a permanent building where it was assembled (below). The $225,000 building for the mockup will house one complete airframe, and a fuselage mockup. Cockpit and interior arrangements for Trans World Airlines and Delta Airlines, first to order the transport, will be installed. The 100x200 ft. building will have color-corrected mercury vapor lighting.



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TRILOK
THE REMARKABLE NEW CONCEPT IN WOVEN-TEXTILE TRANSPORTATION FABRICS

New York Airways Helicopter with interior done by Quanta-Color Corp. in Trilok

As advanced as tomorrow's transportation . . . this amazing new fabric not only meets — but surpasses — the rigid requirements for plane interiors. An exclusive development of United States Rubber, Trilok* has been designed specifically for the aircraft industry to give peak styling with minimum weight (it's only 12 to 14 ounces per square yard). Trilok is woven with unusual deep-dimensional textures that add to comfort and assure coolness. Engineered with a high degree of sound absorbency, Trilok is also exceptionally durable and colorfast far beyond requirements. Pace-setting new Trilok is one of the great family of textiles manufactured exclusively by United States Rubber, Textile Division, Rockefeller Center, N.Y.20, N.Y.

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United States Rubber

Convair Hires Five Research Scientists

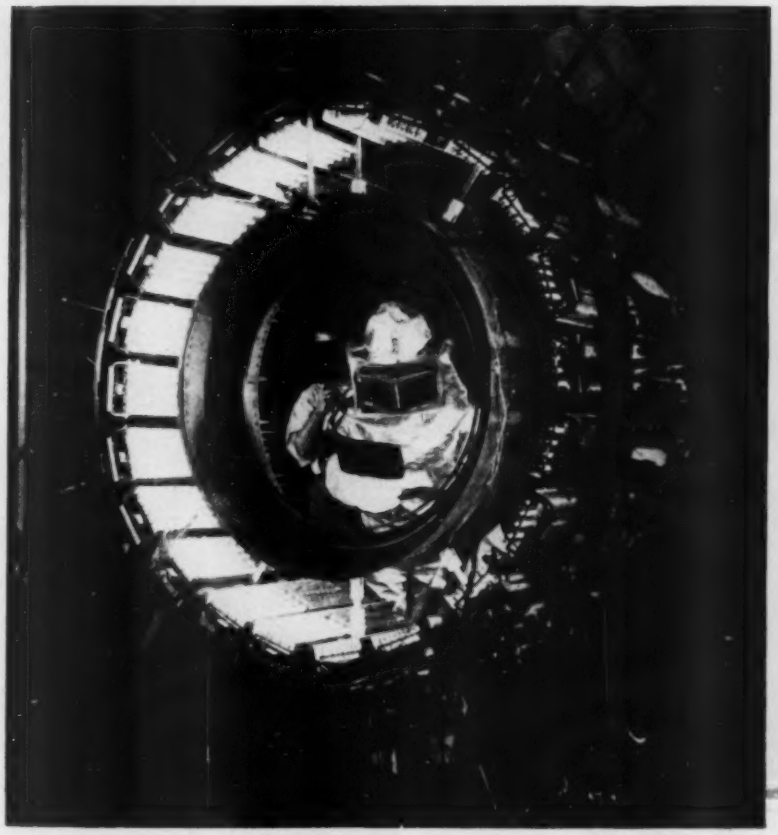
Convair's Department of Scientific Research has added five scientists to its staff.

The specialties of the five indicate the direction being taken in studies of the department, which is devoted to basic research in the fields associated with advanced aircraft and missile technology.

Dr. John E. Naugle was a research associate at the University of Minnesota. His work was with the cosmic ray emulsion group. Researches of this group led to the discovery of the presence of heavy nuclei in primary cosmic rays and the existence of hyperon-containing nuclear fragments. They also led to improvements in photographic emulsion research techniques. He is conducting upper atmosphere research at Convair.

Dr. Orlo Myers is now conducting electron paramagnetic studies and research in thermodynamics and high temperature and tracer chemistry. He was formerly with the Stanford Research Institute where he did work on a fundamental program to determine high temperature thermodynamic properties of a series of fluorides. He also has studied the kinetics of decomposition of rocket propellants, heat and mass transfer in liquid metals, vacuum sparking, solvent extraction and kinetic studies using tracers.

Dr. Harold A. Papazian will do research in the chemistry and physics of free radicals which will contribute to development in the field of rocket propulsion. He came to Convair from the Research Division of Raytheon Manufacturing Co. where he studied solid



Torture Ring

Engineers study the triple-torture effects of simultaneously heating and cooling a metal ring while subjecting it to stress at North American Aviation's Los Angeles Division. The outside of the ring, which simulates a portion of an aircraft's fuselage, is heated to about 450F by the battery of infra-red lamps that encircle it, while the inside is cooled to 90F by cold air blown through perforated aluminum tubes. Meanwhile hydraulic devices pull at the metal to simulate stresses that might be encountered in flight. The maze of tubes and wires surrounding the circle carry power for the lamps, air for cooling, and electronic impulses that report data to recording devices.

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TURBINE AIRFOILS

Therm-electric METERS CO., INC.

Ithaca, New York

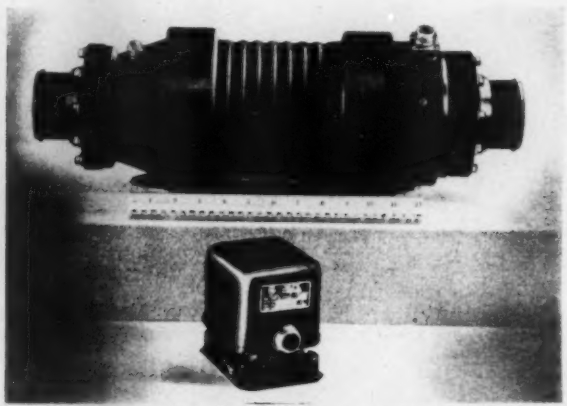
KB-50 carries out simultaneous refueling of three North American Super Sabres.

Fuel Flow Measured 50 Times Faster With New General Electric In-Flight Refueling Transmitter

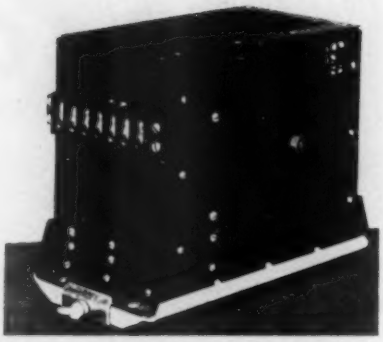
Developed to help speed in-flight transfer of fuel from Air Force KB-50 and KC-135 flying tankers to bombers and fighters on long-range operations, the G-E In-Flight Refueling Transmitter is capable of measuring up to 10,000 pounds of fuel per minute as compared with the 200 pounds per minute performance of earlier models. The new transmitter unit, weighing only 17 pounds, is mounted in the fuel line leading to the line or boom which extends from the tanker plane during refueling. The transmitter complements its light weight with rugged construction to withstand the shock of peak flow surges including reverse flow—the sucking back of fuel when the refueling line or boom is retracted into the tanker. The flowmeter transmitter can operate at pressures up to 480 pounds per square inch, metering the fuel transferred with error of less than one per cent. Density compensation is not required, and the new flowmeter is insensitive to temperature and altitude changes.

For more information on this or any other aircraft fuel control instruments call your nearest General Electric Apparatus Sales Office.

Mounted in each of the three refueling lines on the tanker, the General Electric in-flight refueling transmitter meters fuel to the receiving aircraft at pressures up to 480 pounds per square inch.



This lightweight G-E transmitter can measure up to 10,000 pounds of fuel per minute. One power supply provides a constant-frequency source from which all three transmitters are operated.



10 pound transformer-rectifier has expected life of 3500 hours at temperatures to 71 C.

General Electric, unregulated transformer-rectifier will give the Douglas DC-8 28-volt d-c power. Voltage fluctuation is limited to ±7.3 percent without additional regulation.

Lightweight, Unregulated Transformer-Rectifier for Douglas DC-8 Features Narrow Voltage Fluctuation

Four General Electric unregulated, airborne transformer-rectifiers, rated 35 amperes, 28 volts at full load, will furnish direct-current power for the new Douglas commercial jet airliners. The significant feature of the unregulated units is the minimum voltage fluctuation and one volt maximum peak ripple attained without reactors or other bulky regulation components. Within a load range of 0 to 25 amperes and 400-cycle input changes ranging from 195 to 202 volts line to line, the output voltage will remain within the limits of 25 to 29 volts. Maximum performance within these limits can be expected through 3500 hours of operation and at temperatures up to 71 C.

By using a transformer-rectifier, the new jet transport will have a reliable source of "on-the-spot" d-c power without the weight penalty of additional generating equipment and long bus runs. The G-E unregulated transformer-rectifier weighs less than ten pounds and contains no moving parts. The unit consists of a three-phase transformer and Vac-u-Sel* high temperature, selenium rectifier cells and contains a shunt for measuring output current. Each is convection cooled and has an expected life of 3500 hours when operated at 35-ampere loads; within the limits of 25 to 29 volts over any input or load condition up to 25 amperes the same life is expected.

For further information on General Electric airborne, transformer-rectifiers, both regulated and unregulated, contact your nearest G-E Apparatus Sales Office or check "A" on coupon below.

New 2PDT Subminiature Relay Gives Reliable Performance at 30 G Shock, Temperatures to 125 C

Latest addition to General Electric's line of hermetically sealed relays qualifies for severe-condition applications.

Built to give increased reliability to electronic equipment subjected to severe environmental conditions, the new General Electric 2PDT Subminiature relay withstands 30 G's shock with no contact opening in either energized or de-energized positions. The relay, rated 2 amps, is suitable for continuous operation in 125 C ambient temperature and is unaffected by vibrations of 10 to 55 cps at .12 inches total excursion or 55 to 500 cps at 15 G's acceleration. The operating advantages of this relay are further complemented by small size, .651 inches in diameter by 1.83 inches in length for the standard unit. The relay weighs approximately one ounce and is available in a wide variety of coil ratings.

Fatigue resistance is increased by heat treating the beryllium copper contact springs. The relay magnet is the conventional plunger type with provision made for adjusting the open gap position of the plunger after the relay is assembled in the can. Operating time with nominal voltage applied to the coil is approximately 10 milliseconds; drop-out time approximately 5 milliseconds.

*Trade-mark of the General Electric Co.

For more information on the 2PDT relay and other types of General Electric hermetically sealed relays, contact your nearest G-E Apparatus Sales Office. Check block "B" below for your free copy of the new 2PDT subminiature relay brochure.

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- ☐ "A" Airborne Transformer-Rectifiers Bulletin GEA-6443
- ☐ "B" New 2PDT Subminiature Relay Bulletin GEA-6412
- ☐ For immediate project
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ACTUAL SIZE

LIGHTER, SMALLER ADF
WITH GREATER ACCURACY, HIGHER SENSITIVITY

NEW, COMPACT BENDIX DFA-70 HAS INCREASED EFFECTIVE RANGE, ELECTRICAL TUNING, FLUSH-MOUNTED ANTENNA

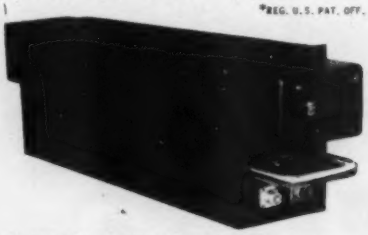
Bendix* ADF—long the "standard of the industry"—reaches another new high in performance and reliability with this new, improved DFA-70 system. Covering all frequencies from 90 to 1750 kilocycles, it provides both visual and aural navigation information, including narrow-band Consol reception. And with the greater accuracy and higher sensitivity that have been built into the system, a significant increase in operating range is obtained.

One of the important features of this new system is the electrical tuning which permits the Control Panel to be located as far as 50 feet from the receiver. In the design of the DFA-70 Control Panel, shown above, human engineering principles have been used to make tuning fast, easy and precise. Frequency knobs are labeled for quick identification; panel markings are large and easy to read; location of controls on the panel is planned for maximum accessibility.

Another important feature is the newly designed flush-mounted loop antenna. With this new unit, precipitation static is greatly reduced and drag is completely eliminated.

For complete information and specifications about the DFA-70, write Bendix Radio Division, Aviation Electronic Products, Baltimore 4, Maryland. Or West Coast—10500 Magnolia Boulevard, North Hollywood, California; Export—Bendix International Division, 205 East 42nd Street, New York 17, New York.

*REG. U.S. PAT. OFF.



½-ATR DFA-70 RECEIVER features sub-chassis construction, ARINC Class 1 ruggedized tubes, improved circuitry for minimum power consumption.

Bendix Radio Division

Bendix AVIATION CORPORATION

state physical-chemical properties. He also has investigated volatile impurities in semi-conductors such as silicon and germanium.

Eugene J. Putzer, staff scientist in mathematics, taught the subject at Macalester College, St. Paul, Minn. He is a specialist in nonlinear differential equations which are used in servomechanism analysis. He now is analyzing the equation that governs operation of error-limited servos.

Robert J. Good will do research in surface chemistry and adhesion. He worked on the subject at the University of Cincinnati.

The new appointments bring to 13 the number of scientists employed full-time by the department.

Particles Provide Stronger Magnets

Iron magnets made of elongated submicroscopic particles of iron pressed together are as strong as the best Alnico type permanent magnets and can have 100,000 times the resistance to demagnetization that ordinary iron magets have, according to the Instrument Department of General Electric Co., Lynn, Mass.

Submicroscopic iron whiskers are grown by electroplating iron onto a

German Dilatometer

Dilatometer is made in Wetzler, Germany, by the E. Leitz Co. to determine coefficients of expansion of metals under heat. Used as aid in probing thermal barriers at Northrop Aircraft, Inc., machine is so sensitive the effects of human breath is registered on ground glass screen. Dots on screen were caused by gentle blowing on test specimen by young woman laboratory technician. Cylindrical portion at right is an electronic furnace capable of heating test specimens to 2,000F.

A little pull in the right place . . .

the ROBINSON wire twister

Aircrafts' Who's Who Reports

A cross section of the Who's Who in the aircraft industry—including Douglas, Allison, Fairchild, Grumman, Martin, Republic, Canadair Ltd., Pratt and Whitney among a host of others — is reported to have reduced engine wiring time as much as 66⅔. This saving is effected by the use of the new Robinson Wire Twister, an improved model of the ones that have seen service with the army, navy and airforce since 1943. Improvements include the exclusive diagonal jaw design that permits easier access to hard-to-reach areas, and clamps a vice like grip on the wire by pulling it into a 30° bend thus delivering added leverage for twisting.

In addition to the greatly increased engine wiring speed, users attest to improved shop safety — fewer skinned knuckles and bruised fingers.

Besides their production line assignments, Robinson Wire Twisters readily adapt in the shop to bench work, on radio and radar equipment, on magnetos, carburetors, instruments and sub-assembly work of all kinds.

List price is $19.50. Write for fully descriptive literature to Ralph C. Robinson Company, Dept. W, Box 3494, 2516 Crosby Way, North Sacramento 15, California.

. . . saves ⅔ the usual wiring costs

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announcing the achiever!

AC HAS COME UP WITH A BUILT-IN "ONE-TRACK MIND" FOR GUIDED MISSILES

With one of the most significant advances yet made in the field of guidance, AC adds a vital new brain to America's arsenal of defense.

The ACHIEVER—a new type of inertial guidance system —brings fantastic accuracy, ruggedness and dependability to Air Force ballistic missiles.

Heart of the system is a remarkable gyro stabilized platform of such stability that the slightest variation in windage or missile velocity can instantly be sensed and precise corrections made.

This great new development is one phase of AC's work as a prime contractor for the Air Force Ballistic Missile Program. It is one more example of AC's leadership in the field of electro-mechanical research and development.

GM

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molten metal cathode and then plucking the dust from the liquid metal by conventional magnetic action.

The whiskers are aligned by a powerful magnetic field and compacted together under great pressure along with a binder. As this binder can be metal, plastic, glass, or rubber, the final product can have wide versality, GE's Dr. Thomas Paine, leader of the research group which developed the magnet, said. The closer together the particles in the binder, the stronger the magnet; the further apart, the greater the resistance to demagnetization.

For the future, GE predicts that this method will produce magnets of "undreamed of" power.

Reason for the strength of these magnets is that unlike conventional magnetized pieces or iron, these fine particle magnets are not divided into domains of conflicting magnetic directions. Instead the fine particle magnets are composed of elongated particles, all lined up in the same direction. The particles have been made so small that they cannot support conflicting internal domains, Paine said.

The magnet is not expected to be put on the market for a matter of years. However, GE is now investigating its use in miniaturized aircraft instruments, as engine tachometers, and for use in the neutron flux of nuclear reactors.

British Optimistic on Vanadium Research

London—Series of lightweight vanadium metal alloys may become available to industry as a result of research now being carried out in Britain into methods of producing such alloys on a commercial scale.

Problem which has hitherto hindered its development as a commercially usable metal, as distinct from an alloying additive, is the difficulty of producing satisfactory containers for handling the molten vanadium metal during manufacturing processes.

Promising results are now being achieved in the development of special refractories for this purpose and indicate that the difficulty may soon be overcome, thus enabling vanadium and vanadium alloys to be produced on a commercial scale.

Most promising fields for the application of this metal are the aircraft industry and the nuclear engineering industry.

Vanadium, a very hard white metal, is only a little heavier than titanium and is intermediate between titanium and zirconium in many of its industrially important physical qualities.

It may also possess a number of economic advantages over zirconium in some industrial applications.

SUB MINIATURES

Now you can get sub-miniature "key-locking" inserts in 0, 1, 2, 3, and 4 thread sizes. Sub-miniatures, made only by Kelox, offer design engineers the opportunity for making small assemblies even smaller and lighter. Identical to regular Kelox inserts, these new "key-locking" sub-miniatures will not rotate or loosen with vibration . . . provide maximum holding power . . . save weight and space.

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The Kelox system of threaded and tapped inserts offers the ultimate in weight- and space-saving design. Maximum holding power between parent and bolted piece is obtained because patented "key-locking" produces no stress concentrations and permits complete use of external threads. Independent laboratory tests have verified that "key-locking" successfully withstands application of maximum torque.

Low cost, easy-to-install Kelox inserts are available for internal thread sizes from 0 to 3 inches. Made of many materials (alloy steel, corrosion-resistant steel, brass, aluminum alloy, monel, etc.), Kelox inserts are also available with thin or thick walls for use with various materials —aluminum, magnesium, "pot" metal, plastic, titanium, steel, etc.

EXTRA LARGE

For big assemblies, Kelox extra large inserts (up to any specified diameter) give unmatched performance—performance that verifies the soundness of Kelox exclusive "key-locking" principle. Only Kelox offers you a positive, non-rotating insert that does not break down protective coatings like ceramic . . . requires no special threads . . . gives maximum reduction of space and weight.

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Naval Research Evaluates Man's Limits as Aircraft Control System

Man's abilities and limitations when part of an aircraft control system were summarized by Max Lund, Office of Naval Research, in a talk before a recent meeting of the American Association for the Advancement of Science in New York.

In comparing humans to "other black boxes," which close the aircraft control loop, Lund evaluated man in three control functions.

• As a receiver.

Man can see a $\frac{1}{16}$ dia. wire $\frac{1}{2}$ mi. away. He can receive code by tactual vibrations more rapidly than he can by ear.

He can even (in some hypersensitive cases) hear the sounds of air molecules colliding in random Brownian movements. In fact the sensitivity of both the eye and ear is close to the theoretical limits for resolution of a physical system, Lund said.

Unfortunately man's response times are long (150-250 milliseconds), his sensitivity ranges limited in band pass or frequency range and he becomes easily confused when simultaneously subjected to multiple inputs.

But, conceded Lund, man is somehow doing jobs which nature never intended him to do. He works on a carrier deck despite 140-150 db. noise. He flies high and fast where the effects of empty field myopia and split second closure times combine to prevent him from seeing the "traffic."

As an example of man's uselessness as a receiver in the aircraft's guidance loop, Lund cited the jet plane which flew through a formation of jets without seeing them. He was probably referring to the incident which has been published in the press and confirmed by USAF concerning the single B-47 which flew through the formation of four B-47's carrying off a piece of one plane's tail in its wing. The only "receiver information" recalled by any of the five pilots was a recollection by one of the pilots who said that there had been some "bumpiness."

• As a computer.

As a computer man scores exceptionally well. In controlling a hovering helicopter which is dipping sonar equipment, for example, a pilot can maintain a fixed position which would require the simultaneous solution of 12 equations if done by a computer. Even if the sonar signal is 10 or 12 db. below a random noise level, man can by ear, and by examining the signal envelope visually, tell whether he is listening to return from a school of fish, a whale or a submarine.

Although his memory of sensory functions and his speed and accuracy at numerical computations is poor, man remains the only known computer which can solve problems by logical induction.

Man's motor responses (muscle movements) are limited to a few tenth hp. output at 25 bits per second (five or six letters on a typewriter). His motor responses have a bandwidth of about 10 cycles per second, with the natural frequency at about $\frac{1}{2}$ to 1 cps. It was suspected that one experimental transonic plane had its wings torn off when the resonant frequency of the wings became sympathetic with the pilots own natural frequency in moving the controls, Lund said.

Men Vary

"These characteristics within the three functions discussed are common to all men in one degree or another," Lund said. "It must be remembered that men vary widely in their capacities, body sizes, training and skills. Until quality control is utilized in the acceptance of new models of the human being, the engineer should design equipment which can be used adequately by any member of the population likely to use it."

Even if a control job is well within man's physiological abilities, it may not be acceptable to him for psychological reasons. If it bores him, Lund said, he will not want to do what is well within his limitations.

Man's Limits

"Whether man will be a decrement in a system depends on what he is required to do," Lund said. "It is obvious that he cannot exert forces beyond the limits of his strength. He cannot see infra-red or ultra violet. He cannot see or hear a signal if the background contrast completely masks it in noise. If he is harnessed to a seat, he cannot manipulate controls that are 30 or more inches away. If he is expected to respond to several messages at the same time he will be unable to get much intelligibility from them.

"We in engineering psychology do not see these as human limitations but rather as examples of poor systems design.

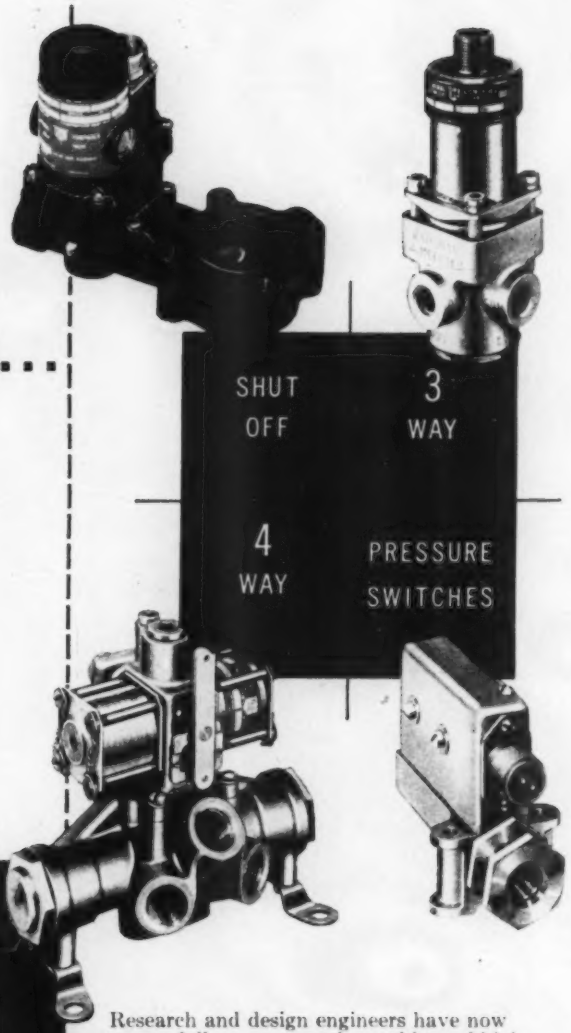
"If a system is properly designed we need not worry about limitations. We can take advantage of man's unique abilities, the flexibility which as yet has not been duplicated in a machine, his ability to separate signals from noise, and his ability to make decisions in complex and changing situations."

Plexiglas Gauges

Plastic fixtures permit visual check on fitting fuel cells for F8U-1 Chance Vought Crusaders. Frequently, rubber fuel cells had to be put in the aircraft by feel since the smaller ones might be in areas too small for a workman to do the job visually. Installing the cells in the plexiglas gauges before hand permits the visual spotting of defective fittings. Fixtures were made of half-inch plexiglas. Each of fuel cells has its own acceptance gauge into which it is fitted.

acceleration...

another barrier conquered!



hi-g

Research and design engineers have now successfully overcome the problem of high acceleration forces resulting from shock, vibration and centrifugal force which impairs performance of men and equipment alike.

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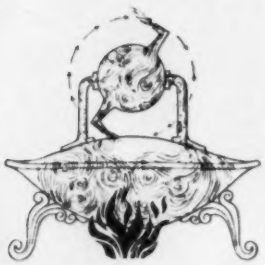
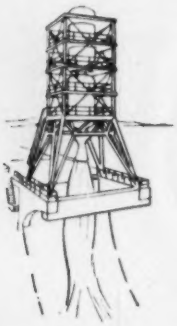


Only yesterday they called it "the art of rocketry." Today, in the first rank of aeronautical science, rocket propulsion is an engineering discipline, an applied technology, and an established industry. The applications for propulsion devices are manifold, the potentialities unbounded.



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THRUST & DRAG

Cliches continue to abound in engineering jargon, and one of the finest (and longest) examples of the mixed-metaphor cliche is this one, guaranteed to be here reproduced as delivered over the telephone by an executive of a major manufacturing company. Speaking of his company's recent entry into a specialized field, he said that the reason the company got in now was because it ". . . didn't want to fall asleep at the switch while the parade passed by with someone else carrying the ball past all the roadblocks."

* * *

The problem of the bumblebee that shouldn't have flown but always did has been one of the classic canards of the aircraft industry. It has been used against every practicing aerodynamicist at one time or another to question his calculations.

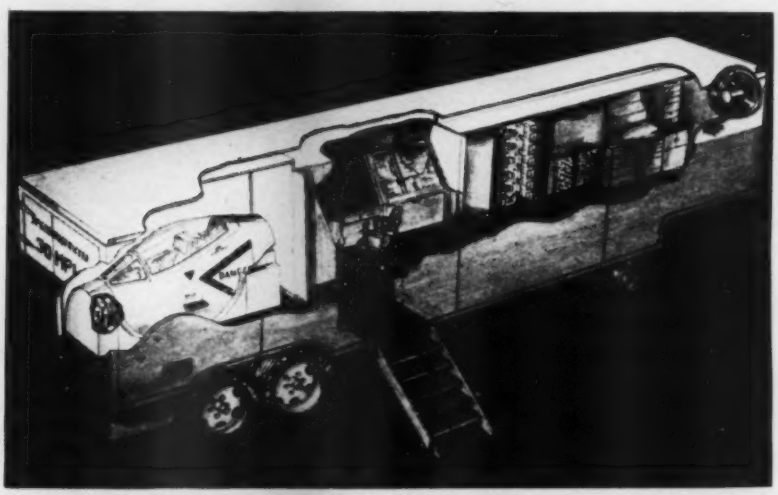
Having been an aerodynamicist whose calculations have been questioned, I always felt rather keenly toward the man who first perpetrated the bumblebee routine.

It turns out that he was a Frenchman named Magnan, a naturalist who having nothing better to do, calculated bumblebee flight on the basis of aerodynamic theory—presumably steady-state-aerodynamics.

His results showed that all bumblebees should be grounded. But the bees, exercising the independence beloved of Frenchmen everywhere, just kept on flying and flying.

Actually Magnan had made the mistake that every aerodynamicist has made at one time: He used the wrong theory.

This doesn't confirm anything, except that bumblebees can fly, aerodynamicists can be wrong, and Magnan was to blame for the contrary opinions.



LINK'S F11F-1 TIGER electronic flight simulator is packed away in a 40-ft. long trailer. Actual cockpit section at left is hydraulically mounted to simulate rough air and buffet motion. At center is instructor's console followed by computer section and maintenance test area.

Link Expands in Simulator Field

Link Aviation's expansion in the electronic flight simulator field includes these recent—or immigrant—contracts for simulators for both military and commercial aircraft:

- **Grumman F11F-1** Tiger supersonic fighter—first of two trailerized flight simulators has just been delivered to the Navy. Called Operational Flight Simulator Trainers (OFST), the devices were built under a contract with the Navy's Training Devices Center, Port Washington, N. Y.
- **Chance Vought F8U-1** Crusader supersonic shipboard fighter under production for the Navy.
- **Convair F-102A** supersonic interceptor fighter being produced for the USAF.
- **Convair F-106A** supersonic interceptor fighter also being built for the Air Force.

In addition, the company is making a Radar Signal Simulator (RSS) for the Air Force's Martin TM-61 Matador pilotless bomber. The Matador simulator is used to train launching and guiding crews.

In the commercial aircraft field, Link cites these contracts:

- **Boeing 707** turbojet transport.
- **Lockheed Electra** turboprop transport.
- **Douglas DC-8** turbojet transport.

Ἥρωνος Αἰολοπύλη.

Heron's Aeolipile

In the 3rd Century B.C., 2,000 years before Newton, Heron of Alexandria anticipated modern concepts of jet propulsion with his working model of the aeolipile, a steam-driven forerunner of today's rocket engines.

Heron, Newton, Goddard, von Kármán . . . the principle endures, the need evolves, the powerplant is born. In our time, Aerojet-General Corporation represents the culmination of research, development and manufacturing in rocket propulsion.

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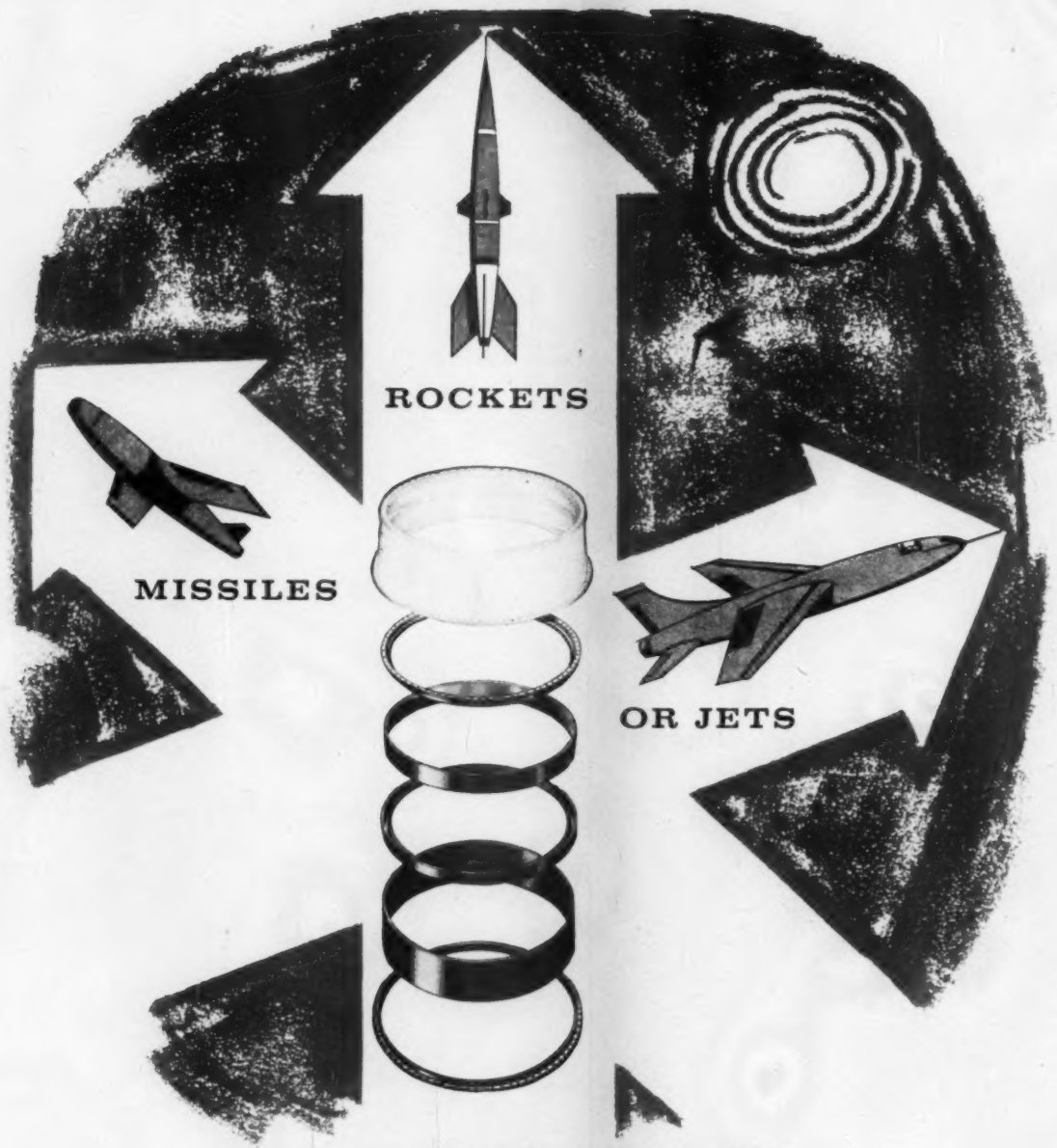

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Trainer Stresses Completeness, Low Cost

By George L. Christian

New York—Aircraft procedures trainer—more complete than earlier models but less complex and expensive than simulators—has been designed and built by Burton-Rodgers Technical Training Aids, Inc. Cost is approximately $115,000.

Trainer is a dual purpose device, adaptable to the Douglas DC-6A Liftmaster cargo plane and the DC-7 passenger transport. The device was developed for use by American Airlines in its flight training program.

Recent Installation

American installed the first unit recently at its Los Angeles flight training base.

Two others are being installed at LaGuardia Field, New York and at Fort Worth while a fourth is scheduled for installation at Chicago.

Burton-Rodgers believes its trainers will spell economy for both commercial and military users.

Because the trainers do not include means for simulating navigation and actual flight maneuvers, the cost, complexity and weight is considerably reduced compared to a full-fledged electronic simulator. Result is that several may be placed at strategic locations along the route of a major airline, saving travel time for crews to be trained. For smaller airlines, which cannot afford the $500,000 or more that simulators cost, the procedure trainers offer an economical means for flight crew training to an extent hitherto unavailable.

Also, since procedure trainers are cheaper to operate and maintain than simulators, they can be used to train crews in all phases for which they are designed, such as cockpit familiarization, engine and propeller operation, and fuel management. This allows the more expensive simulator time to be spent more efficiently on checks which it alone can perform, such as navigation and actual flight handling characteristics.

Dual Purpose Trainer

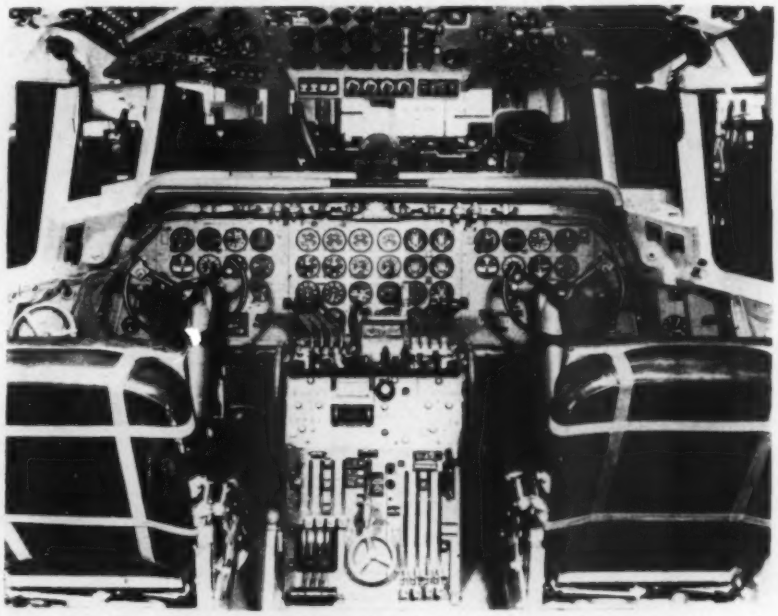
Novel (and money-saving) feature of the new trainer is its ability to serve as a procedure trainer for two different aircraft with certain important differences in cockpit controls and instrumentation.

Controls which differ from one plane to the other include engine blower, dive brake, and various switches. To take care of the differences, both sets of controls were built into the trainer and provisions were made to remove, cover, or otherwise render inoperable the inapplicable set of controls.

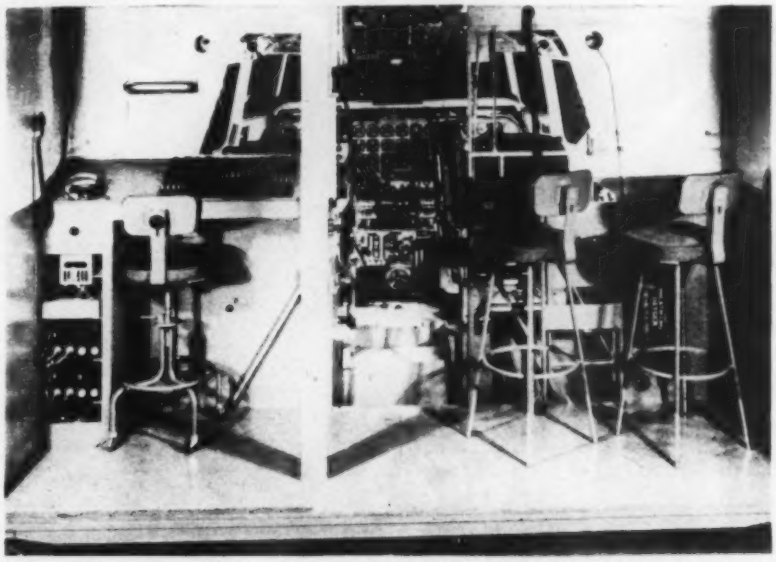
To solve the problem of instrumentation differences, the conflicting dials were mounted back-to-back on a pivot to allow quick reversal from one to the other.

So simple is the conversion from one type of cockpit to the other that total changeover time is less than five minutes.

The procedure trainer is designed to

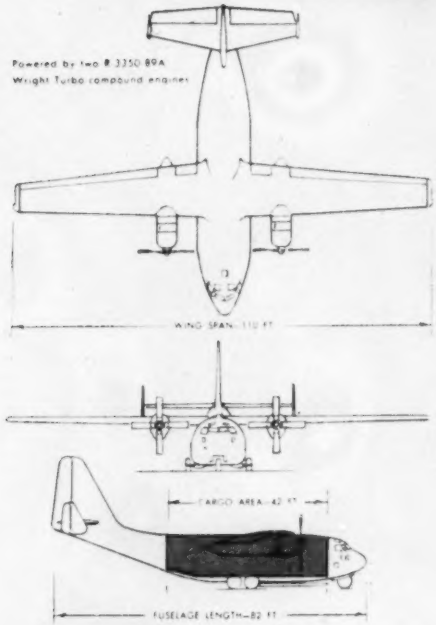


COCKPIT of B-R DC-6A/7 procedures trainer shows faithful reproduction of all controls, instruments and general configuration.



INSTRUCTOR'S STATION, located behind the cockpit, is shown at left. Two observers seats are at the right.

The first Pantobase BLC transport



The usefulness of military transport aircraft has been extensively increased with the introduction of the Stroukoff C-134. Produced for the United States Air Force this rugged heavyweight requires extremely short take-off and landing runs and can operate from any surface – land, sand, ice, water, etc. Advanced airframe design has been combined with Stroukoff Pantobase and Boundary Layer Control Systems to produce a new type of aircraft equipped for a variety of assault and logistic missions requiring operation without the limitation of conventional runways. The Stroukoff C-134 is destined for an important role in modern military strategy.

Interesting opportunities for qualified engineers in many fields exist at Stroukoff.

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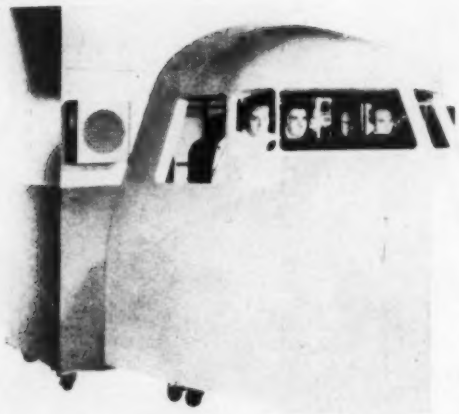


FRONT VIEW of the DC-6A/7 procedures trainer. Large cabinet in front of the cockpit houses the four engine computers. Instructor's station is behind cockpit.

teach both normal and emergency operating procedures, and the company cites these aircraft operating phases which its trainer will duplicate:

• **Engine operation** (including sound effects)—cranking, starting, ground run-up, blower shift, and flight operation.

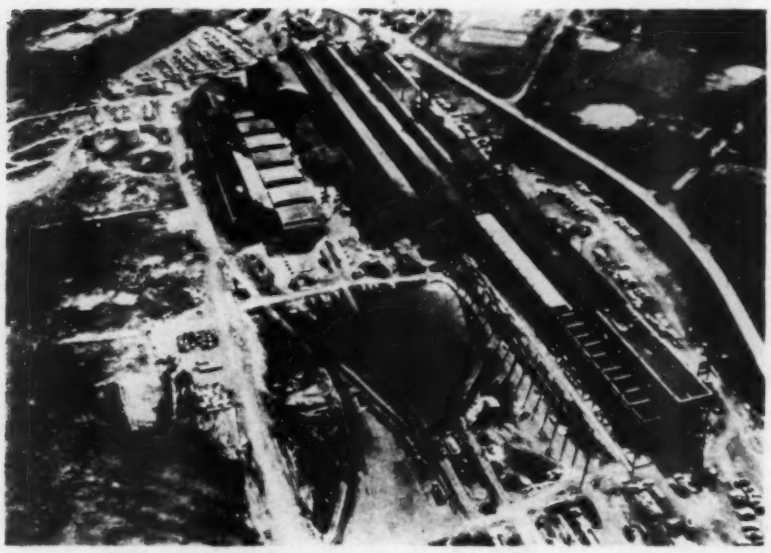
The latter includes operating changes due to altitude variations. Malfunctions which the instructor can put into the machine include:

Ignition failure, supercharger malfunction, instrument failure, and power loss.

• **Propeller operation**—governing, synchronization, feathering, unfeathering and prop reversal, and the failures affecting these operations.

Some of the other systems which are completely operable in the trainer, according to the manufacturer: both a.c. and d.c. electrical systems; normal and emergency hydraulic systems; vacuum system; all heating and de-icing systems; fire warning and fighting systems; water injection; entire fuel system, including fuel transfer, cross feeding and tank selection; and the intercom system.

The device is designed for quick disassembly and easy shipping. It can be broken down into eight sections, none larger than 60x80 in. if it has to be moved.

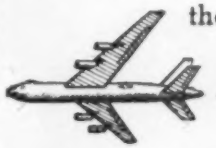


Mallory-Sharon Plant

Aerial view of Mallory-Sharon facilities at Niles, Ohio, including titanium laboratory, melting plant, rolling mill and engineering and administrative buildings. New melting plant addition in foreground compares to length of two football fields. It will house electric furnaces now being installed. Steelwork also is going up at site for new quality control laboratory.

Want to save weight?

FINN lightweight mounting bases could save 7¾ lbs. on the **B-52**



FINN lightweight mounting bases could save 5½ lbs. on the **F-102**

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Data for determining the accuracy of the bombing runs was computed by the MSQ type of Command Guidance System, designed and built by Reeves Instrument Corporation. Tracking by radar, the system provides a continuous plot of the plane's ground position. The point of bomb release is plotted, and from it the point of impact determined to a very high degree of accuracy. The MSQ type of system can also be adapted to Command Guidance of fighter bombers for close support bombing and strafing of enemy positions.

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CL-28 Hydraulics Modified for Combat

New York—Static ground check of the entire flight control system and the possibility of combat operations dictated certain hydraulic system changes which Canadair made to the CL-28 when adapting its maritime reconnaissance plane from the Bristol Britannia commercial airliner (AW Dec. 31, 1956, p. 50).

Canadair wanted to be able to check free aileron movement without having to taxi the plane—as has to be done with the Britannia—and wanted separate emergency lines for the brake system in case the main system got shot up.

Still another change was to redesign the CL-28's hydraulic system to operate effectively at temperatures as low as −65F.

Minimum operating temperature of the Britannia's present hydraulic system is −40F.

Control Surface Locks

The Britannia's flight control system is servo tab operated. A torque tube drive system connects the pilots' controls to the tabs. The main aileron, elevator and rudder controls are full-floating. Both ailerons and elevators assume a full-down position when the aircraft is parked with the hydraulically-actuated control locks in the off position.

Canadair insisted on having a means of checking freedom of movement of all three sets of controls with the aircraft stationary on a ramp. Running up the inboard engines provides sufficient slip stream to check freedom of movement of elevators and rudder, but the ailerons could not be checked with the Britannia system without taxiing the plane down a runway at about 60-70 mph.

A control lock problem which Canadair wanted to delete concerned duration of the locking action. This was dependent on the tightness of the hydraulic system and its ability to maintain existing accumulator pressure. If hydraulic pressure dissipates, the locks become inoperative.

To overcome the first difficulty, Canadair arranged the cylinder to lock the ailerons in the full "up" position. Therefore, when unlocked, the aileron moves from the full up to the full down position, since it is spring-loaded to go the full down position when it is released. This allows a visual check of its being free to move through its full travel.

The second difficulty was licked by redesigning the aileron locking cylinder to include hydraulically-released, collet-type, mechanical locks which will block the ailerons even if the hydraulic pressure to the lock is lost.

Modified Brake System

A dual-piston type of braking system is used on the Britannia. A single, quadruple valve, operated by conventional rudder pedal-mounted, brake pedal linkage, meters pressure to the brakes.

Under normal braking, both main and emergency hydraulic systems supply pressure, through separate connections, to the dual-piston brake. Therefore failure of either system does not affect braking since the second system is already operative.

Canadair thought that, for battle damage reasons, it would be advisable to separate the main and emergency brake valves. Also provided were separate emergency brake lines which lead to shuttle valves at the brake connections.

On the CL-28, the main brake system operates conventionally.

To use the emergency system, the pilot pushes an emergency brake switch on the pedestal. This opens an emergency brake shut-off valve, closes the mainbreak shut-off valve, and energizes the emergency hydraulic system motor-driven pump which gives unlimited braking action in addition to the eight braking operations provided by the emergency accumulator.

The Britannia brakes are equipped with Maxaret anti-skid devices. Canadair says "provisions have been made to fit an anti-skid system to the CL-28 and study is in hand at present on the selection of a suitable type. This requirement was not made part of the original, basic aircraft specification."

Bomb Bay Door Actuation

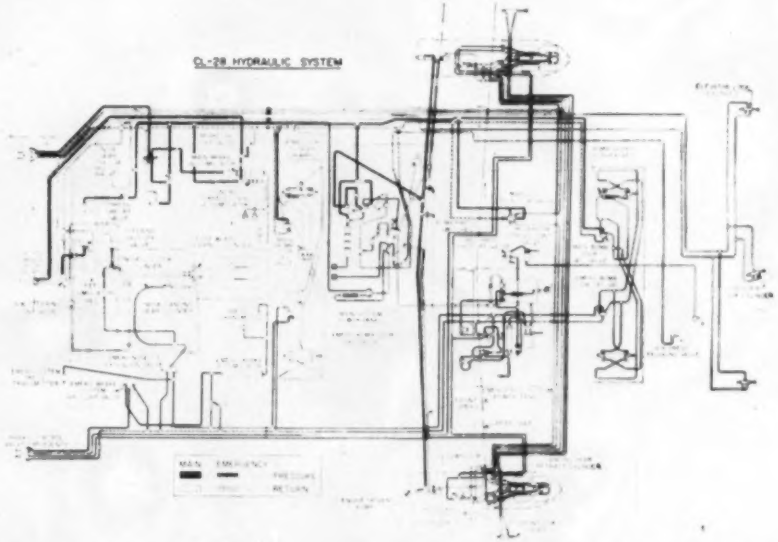
An obvious innovation on the CL-28 over the Britannia is the inclusion of two bomb bays, one just ahead of, the other just aft of, the wing. The doors of both are hydraulically operated. Main and emergency bomb bay controls are located on the forward bulkhead of each bomb bay for easy access in flight. The doors may be manually operated in case of hydraulic system failure.

Bomb bay doors are actuated by integral-type cylinders installed at the forward end of each door. A 2½ deg. over-center movement assures door closure.

The front and rear bomb bays may be opened individually or simultaneously by either the main or emergency hydraulic systems.

Nose Gear Steering Change

Canadair also modified the nose gear steering system by raising its operating pressure from 2,000 to 3,000 psi. Going on the evidence of 3,000 psi. steering systems now in service on many large aircraft, the company deleted the existing reducing valve and redesigned the system for the 1,000 psi. increase in pressure. As a result, the nose gear steering cylinder's size was reduced in



SCHEMATIC of the modified main and emergency hydraulic systems of Canadair's maritime reconnaissance aircraft. Services operated hydraulically include: landing gear, nose wheel steering, control surface locks, brakes and bomb bay doors.

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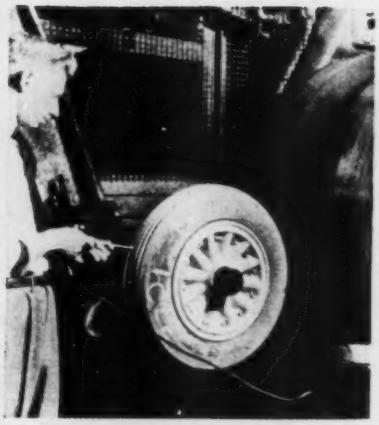


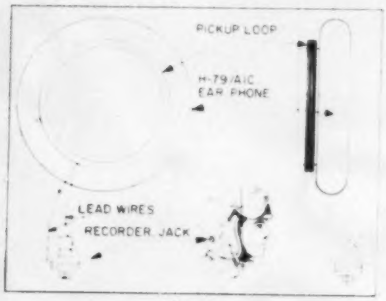
Arctic Tire

This tubeless tire has been soaked in a cold box for 24 hr. at a temperature of –65F. It was then "landed" on a dynamometer wheel at speeds equivalent to 200 mph. and the casing remained airtight, showing the tire's cold weather capability. The tire was developed by Goodyear Tire and Rubber Company's Aviation Products division working closely with Wright Air Development Center. The company is now in quantity production of the tubeless, cold weather tire for the military.

a ratio of 3:2, which gave a weight saving of 9.6 lb.

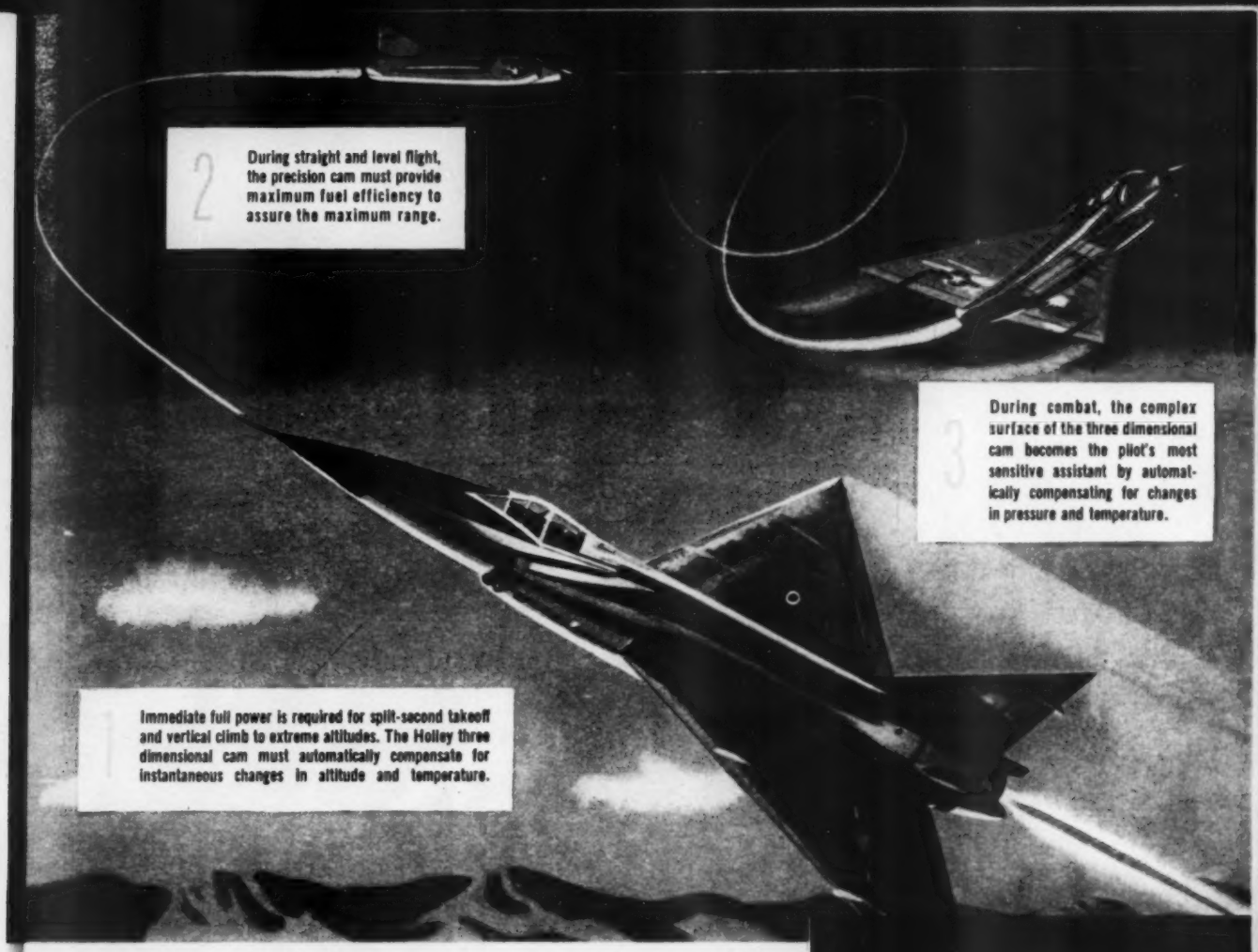
A solenoid-operated shut-off valve closes the nose gear steering circuit when the plane's weight is no longer supported by the strut after takeoff. This prevents madvertent operation of the steering system when in flight.

The first CL-28 is scheduled for flight testing in April.



Small Tape Recorder Used for Evaluation

Central Air Defense Force with headquarters at Grandview AFB, Mo., replaced the long-used knee-board with a midget tape recorder for pilot flight evaluation. Knee-boards are impractical during bad weather and blackout operations because of the close, precision flying required for evaluation which


2
During straight and level flight, the precision cam must provide maximum fuel efficiency to assure the maximum range.
3
During combat, the complex surface of the three dimensional cam becomes the pilot's most sensitive assistant by automatically compensating for changes in pressure and temperature.
1
Immediate full power is required for split-second takeoff and vertical climb to extreme altitudes. The Holley three dimensional cam must automatically compensate for instantaneous changes in altitude and temperature.

How the Holley three dimensional cam functions as an automatic co-pilot

The job of the Holley Power Control for jet aircraft is to sensitively control engine power according to the pilot's requirements and, at the same time, make automatic adjustments for split-second variations in altitude, pressure and temperature. The "brain center" of advanced Holley controls is a three dimensional cam which is so contoured that it can adapt itself to all combinations of atmospheric temperature and pressure, from Thule to the Equator and from sea level to extreme altitudes.

In addition to the automatic compensations made for the pilot by the three dimensional cam, it interprets the pilot's request for changes in power. It's the most important link between cockpit and engine.

The three dimensional cam, like the power control itself, is designed, engineered and manufactured by Holley—one of the world's foremost power control manufacturers.

Typical "brain center" of a Holley aircraft engine control. Note the delicate machined surfaces. Each plays a vital role in mechanically regulating the engine under varying conditions.

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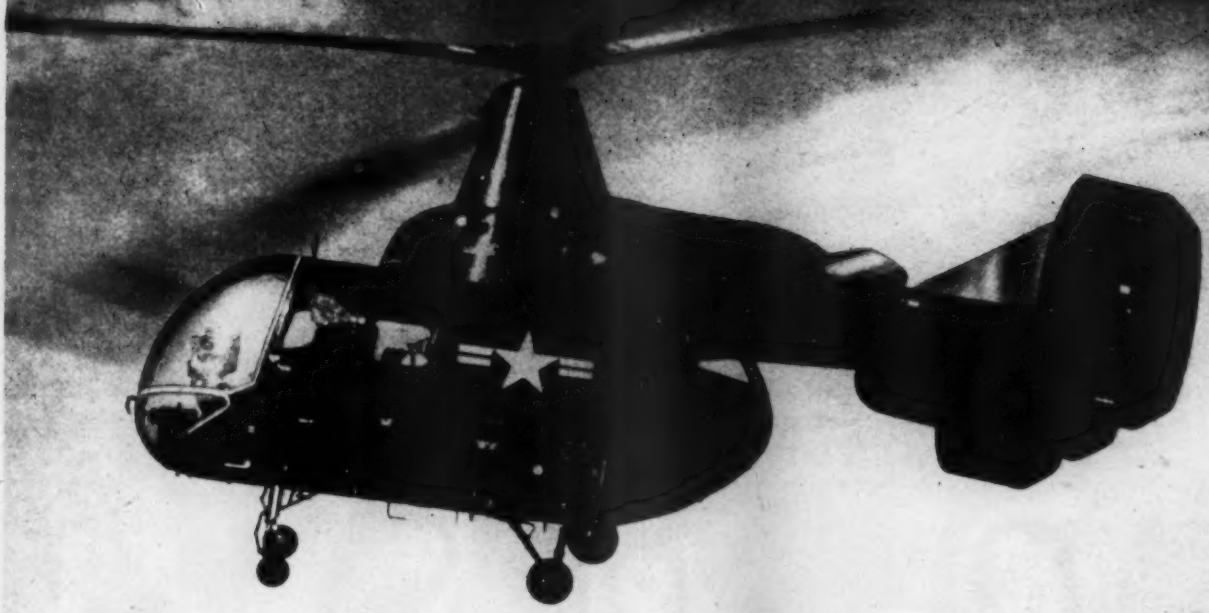

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Kaman built the first turborotor helicopter flown anywhere.

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You will enjoy the story of Kaman's progress, products, projects and people. It's a tribute to Kaman Engineers who made it all possible.

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THE KAMAN AIRCRAFT CORPORATION
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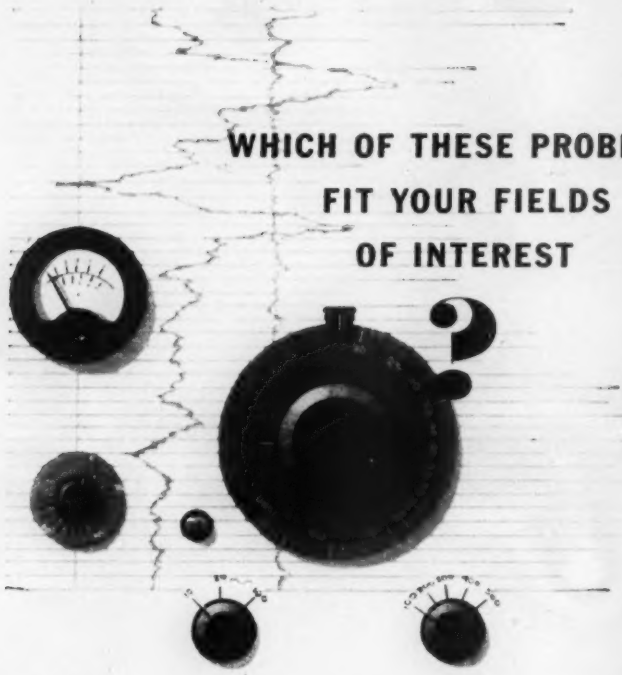


Bell Aircraft is continuing its pioneering in the fields of research aircraft and weapon systems. Testing techniques and equipment must be developed which will establish design acceptibility of radical new developments. The range of testing covers all prototype weapon systems and aircraft elements. Here are just a few problems typical of those we are now encountering.

1. Given the conditions for thrust chamber operation of a total propellant weight flow of 20 lbs. per second and a mixture ratio of 5 to give a chamber pressure of 600 psia; what new tank pressures would be required for a mixure ratio of 4 if the original tank pressures had been 1,000 psia on the oxidizer tank, and 900 on the fuel tank.

2. Develop test planning and group testing of varied projects involving radical airplane concepts and electronic systems for flight control and navigation.

3. In the design of a radar range calibrator test set, a digital counter with a frequency division of 627 is required. The circuit to be designed must operate properly under the following variable conditions:

1) Plate supply voltage is 300 ± 100 volts DC.
2) Filament supply voltage is 6.3 ± 2 volts AC.
3) Temperature range +100° C to -40° C.
4) Shock up to 50 g's.
5) Frequency range (counter input) up to 5,000 P.R.F.

If your qualifications place you in a position to help solve these challenging problems...or if you are now limited in the scope of your opportunity and would like to participate in any of Bell's widely diversified activities in other fields, write today: Manager, Engineering Personnel, Department E-1, **BELL AIRCRAFT CORPORATION, P. O. Box One, Buffalo 5, N. Y.**

BELL Aircraft corp.
BUFFALO N.Y.

keeps the pilot's eyes out of the cockpit most of the time.

At first, the recorder's line was hooked into the pilot's communications system. Mismatch of impedance or excessive single line power in the system produced a loud hum on the recording.

Solution was found in a loop of 200 turns of No. 40 enamelled wire wrapped around a 1.8 in. diameter plastic form. When placed on the earphone inside the pilot's helmet, it eliminates the mitmatch impedance problem. With this set-up, the pilot can transmit to the recorder without having to go on the air.

Total cost of the required jack, plug and wiring is less than 75¢.

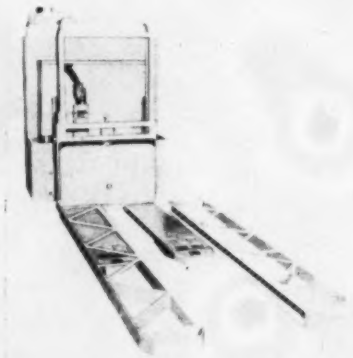
Minneapolis-Honeywell Supplies F-27 Systems

Fuel management systems to be installed on Fairchild's Fokker F-27 Friendship will be supplied by the Aeronautical Division, Minneapolis-Honeywell Regulator Co.

The equipment will include recently-developed light weight capacitance fuel tank units and tank unit compensators.

The system's indicators will be transistorized.

Among new aircraft which will use Honeywell fuel management systems as standard equipment are the Lockheed Electra turboprop and Boeing 707 turbojet transports.



Three-In-One-Truck

This Model M Low Lift truck will do these three jobs: handle over-size pallets with fork extensions attached; carry standard-size pallets with extensions removed; and handle skid loads with hinged superframe (just above rear of forks) lowered on forks. The attachments are available in a wide range of sizes and are adaptable to any pallet-type truck. Manufacturer: Lewis-Shepard Products, Inc., 125 Walnut St., Watertown, Mass.

Bridgeport Thermostat Opens $2 Million Plant

A new, $2-million manufacturing plant was recently opened at Milford, Conn. by the Bridgeport Thermostat Division, Robertshaw-Fulton Controls Company.

The 180,000 sq. ft. plant, more than double the size of the company's previous factory, will produce complex precision instruments, components and associated metallic bellows for jet aircraft, automobiles, home appliances and many other applications.

Plant facilities include a special water treatment installation, complete with two settling ponds, which treats chemical waste to prevent pollution of local streams.

Current employment is over 600 persons.

Compromise Increase Ends Hiller Strike

San Francisco—Machinists' strike which caused a two-week production stoppage at Hiller Helicopters, Palo Alto, Calif., ended with agreement on an immediate 12-cent hourly wage hike across the board.

New 23-month contract with Lodge 1327, IAM, calls for another 7-cent increase next November. Insurance benefits equivalent to 5 cents per hour are to start now.

The immediate increase boosts average wage to $2.36 an hour.

Test Stands Made for Pressure Leakage Tests

Thirty-eight tests stands to check aircraft cabins for pressure leakage will be manufactured by Greer Hydraulics, Inc. for the Navy's Aviation Supply Office.

The units will be put into service aboard some of the Navy's larger carriers and at a number of Naval Air Stations, among them Norfolk, Pensacola, Corpus Christi and Alameda.

Airwork Corp. Appointed Delco-Remy Distributor

Airwork Corporation has been appointed distributor for Delco-Remy aircraft electrical components in all states East of the Mississippi River. Delco-Remy equipment, such as ignition components and spare parts, will be available from Airwork's main warehouse at Millville, N. J. and through the company's branch offices at Alexandria, Va.; Atlanta, Ga.; Cleveland, Ohio; Miami, Fla.; and Newark, N. J.

ACCO products

NEW "NO-MAG"

NON-MAGNETIC AIRCRAFT CABLES

- GOOD THERMAL CHARACTERISTICS
- CORROSION RESISTANT
- HIGH FATIGUE RESISTANCE
- HIGH ABRASION RESISTANCE
- PREFORMED CONSTRUCTION

Eliminates Instrument Interference!

• Just as we expected, many aircraft designers were interested in the recent announcement of our new non-magnetic aircraft cable. If you did not see it, "NO-MAG" has these characteristics:

NON-MAGNETIC PROPERTIES . . . "NO-MAG" cable is made from type 305 stainless steel. It remains non-magnetic after severe cold working—in contrast to standard stainless steel aircraft cable which shows a pronounced increase in magnetism after swaging, wire drawing or similar operations.

This non-magnetic property of "NO-MAG" cable eliminates instrument interference from cable magnetism.

CORROSION RESISTANCE . . . New "NO-MAG" cables have corrosion-resistant qualities similar to, but slightly better than, cables made of standard stainless steel.

GOOD THERMAL CHARACTERISTICS... The thermal expansion characteristics of new "NO-MAG" cable are much closer than those of standard stainless steel or carbon steel cables to the characteristics of aluminum alloys used in aircraft. This greatly simplifies maintaining cable tension under various changes in temperature.

HIGH FATIGUE RESISTANCE . . . Preformed construction and careful processing give new "NO-MAG" cable high fatigue resistance.

HIGH ABRASION RESISTANCE . . . New "NO-MAG" cable shows greater abrasion resistance than standard stainless steel aircraft cables.

TENSILE STRENGTH, while lower than that of stainless and carbon steel, is sufficient to enable replacing these, size for size, with "NO-MAG" on many applications where the characteristics of "NO-MAG" are required.

USE WITH SWAGED TERMINALS . . . Swaged terminals can be applied to standard AN dimensions.

COMPLETE RANGE OF SIZES, CONSTRUCTIONS . . . New "NO-MAG" is furnished in sizes from 1/16" to 1" in all of the standard aircraft cable constructions.

Get the complete story on this new technical development for the aircraft industry. Write today to Detroit office.

ACCO

Automotive and Aircraft Division
AMERICAN CHAIN & CABLE

601 Stephenson Building, Detroit 2
2216 So. Garfield Ave., Los Angeles 22 • Bridgeport 2, Conn.

Aircraft Cable • Swaged Fittings

New Radar Range Readied for ARDC

New flight test range, embracing a chain of radar stations, is being constructed for the Air Research and Development Command at Edwards AFB, Calif.

Range, which will extend from Rogers Dry Lake 400 mi. into Nevada, will be operated by ARDC's Air Force Flight Test Center and the National Advisory Committee for Aeronautics' High Speed Flight Station in testing and developing new aircraft.

Three of the radar systems will be located at specially constructed stations and a fourth, a mobile station, will be installed in a large diesel-powered trailer.

Instrumentation radars are being built by Reeves Instrument Corp., subsidiary of Dynamics Corp. of America, at a cost of about $1,250,000. Equipment is scheduled for delivery next July.

Dual Feathering Lines Go on Constellations

Dual propeller feathering lines for added safety will be installed on the Wright R3350-EA2 engines which will power the Lockheed Model 1649 Super Star Constellations will be delivered to Trans World Airlines sometime this spring.

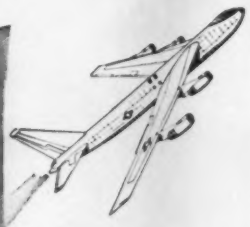
The dual lines will lead from the propeller feathering pump, located behind the fire wall, around the engine's twin bank of cylinders, to the prop governor that is mounted on the nose case.

Should cylinder failure destroy the integrity of one of the lines, the remaining hose will supply the oil pressure (about 700 psi.) necessary to feather the propeller.

A series of check valves will prevent any loss of oil through the ruptured line.

The dual prop feathering lines are supplied by Resistoflex Corporation.

HARTWELL



. . . Symbol of Service to the Aircraft Industry

EXAMPLES OF FLUSH LATCHES DESIGNED BY BOEING . . . PRODUCED BY HARTWELL

The familiar name that identifies each flush latch and hinge built by HARTWELL is more than a mere trademark.

To us this one word — HARTWELL on our product symbolizes a challenge — a challenge to continue building our products to the highest standards of quality and performance required by the aircraft industry.

To you it means sound design, rugged construction, and ample safety factor for long life and dependability — all the things you want in this type of equipment.

Manufacturers of Aircraft Flush Latches and Hinges, Fittings and Cable Terminals. New 72 page, 2-color Catalog illustrates and gives full details of complete line.

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AVIATION SUPPLY CO.
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Branch Offices: Wichita, Kansas; Fort Worth, Texas

OFF THE LINE

A new series of Mechanical Force Gages, capable of holding a maximum reading after the load has been removed, has been developed by The Hunter Spring Co.

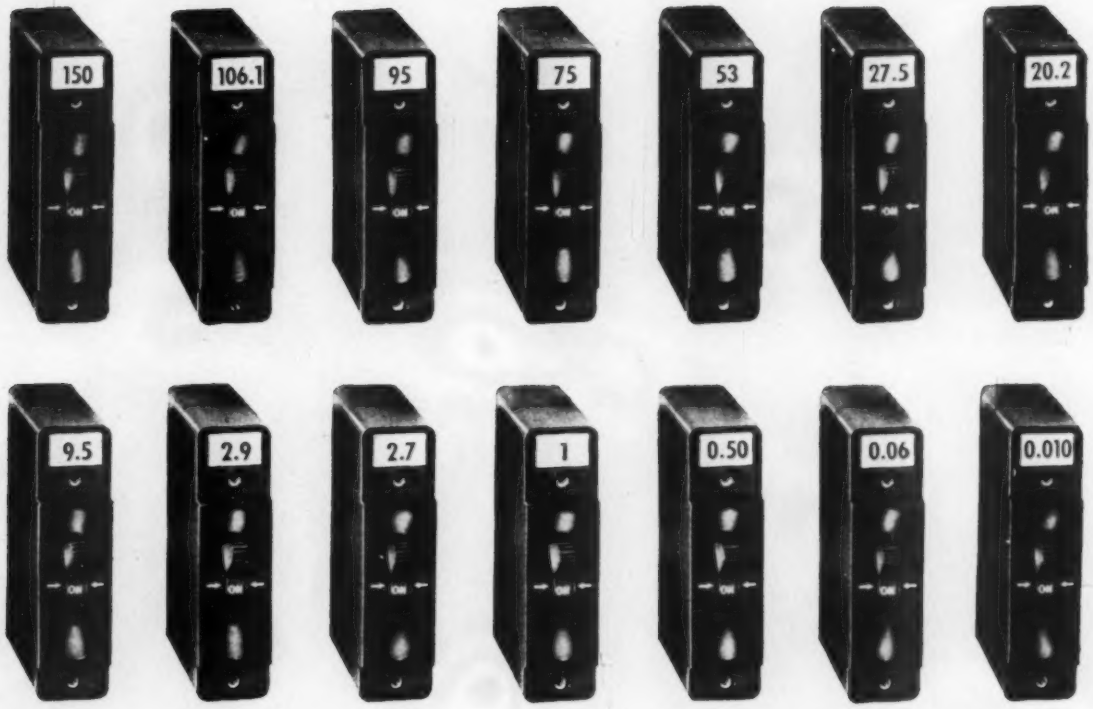
The new gages are very similar to the company's standard Series D line

(AW Nov. 12, 1956, p. 64), have maximum load capacities of 50, 100, 150 and 200 lb. They feature a single control button placed above the dial, which allows the gage either to follow all load applications or hold the maximum load reading.

Order for over $1½-million worth of electro-mechanical actuators has been given Air Associates by Lockheed Aircraft Corp.

The units, designated M-4710M1, will be used on Super Constellations as cowl flap actuators.

Special missile loading truck-trailers, costing approximately $1½-million, will be built for the USAF by Fruehauf Trailer Co., under a sub-contract from Douglas Aircraft Company. The trailers



Imagine...

circuit breaker ratings as low as 0.010 amperes

HEINEMANN Circuit Breakers—complete with your choice of inverse time-delay curves or instantaneous trip—are available in current ratings *as low as 0.010 amperes* . . . an important fact to remember when considering the protection of sensitive equipment. For even at a rating of only 0.010 amperes, HEINEMANN Circuit Breakers still provide fastest interruption of short circuits, retain their set trip points and carry rated capacity through any ambient temperature range, high or low. These exclusive HEINEMANN features are yours in any odd or fractional current rating you may specify . . . but only when you specify HEINEMANN. *For complete details, send for the Circuit Breaker Engineering Guide, Bulletin 201.*

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Circuit breakers

NEW

CALIDYNE
model 174 SHAKER
1500 lbs. force output

SYSTEM NUMBER	1 174/303	2 174/184	3 174/80	4 174/186	5 174/18A	6 174/80
Type	Sinusoidal	Sinusoidal	Sinusoidal*	Sinusoidal*	Random or Sinusoidal	Random or Sinusoidal
Power Supply	Electronic	Rotary	Electronic	Electronic	Electronic	Electronic
Force Output	1250 lbs.	1500 lbs.	1500 lbs.	1500 lbs.	1500 lbs.	1500 lbs.
Frequency Range	5-3500 cps.	5-2000 cps.	5-3500 cps.	5-3500 cps.	5-3500 cps.	5-3500 cps.
Max. Load 10 g.	105 lbs.	130 lbs.	130 lbs.	130 lbs.	130 lbs.	130 lbs.
Max. Load 20 g.	42.5 lbs.	55 lbs.	55 lbs.	55 lbs.	55 lbs.	55 lbs.

*Also adaptable for Random Vibration Testing.

CALIDYNE'S Model 174 Shaker featuring high frequency operation and low input requirements has been so designed that it can be utilized in any one of six CALIDYNE Vibration Test Systems.

The versatility of the Model 174 Shaker extends the range of vibration testing for which this shaker can be used. It further advances CALIDYNE Systems of vibration control, enabling equipment manufacturers to: create vibratory forces over a wide range, measure them, use them for testing and measuring the test results.

Typical vibration testing applications of these Model 174 CALIDYNE Shakers include:

1. **Brute force** shaking at frequencies simulating the worst conditions of ultimate operation.
2. **Structural response** to determine mode shape, frequency and damping characteristics.
3. **Fatigue testing** for high stress providing deflections far greater than normal usage.
4. **Random** vibration testing for more exact simulation of true environment.

For further information call (Boston) Winchester 6-3810

THE **CALIDYNE** COMPANY
120 CROSS STREET WINCHESTER MASSACHUSETTS

FOR *INSURED* ACCURACY
OF AIRCRAFT TEMPERATURE INDICATORS

use the **LEWIS 81T26 THERMOMETER TESTER**

A PORTABLE PRECISION MULTIPLEX INSTRUMENT

USAF TYPE N3 TO MIL-T-7449

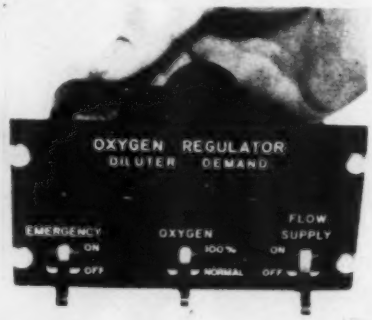
FOR TESTING IRON-CONSTANTAN, COPPER-CONSTANTAN OR CHROMEL-ALUMEL THERMOCOUPLE INDICATORS AND ELECTRICAL RESISTANCE THERMOMETERS CALIBRATED TO THE AN-B-19 OR AN-B-31 TEMPERATURE-RESISTANCE CURVES.

FOR USE IN THE TEST LABORATORY . . . OR IN THE AIRCRAFT

the LEWIS ENGINEERING COMPANY
naugatuck, connecticut

will be built at Fruehauf's new guided missile products plant in Los Angeles.

A new oxygen regulator which is smaller and costs half as much as comparable regulators now on the market, has been introduced by Scott Aviation



Corp. The company reports that several major airframe manufacturers have ordered the new, half-panel diluter demand regulator for jet transport aircraft. Two features of the unit are: The "normal-100%" switch prevents cockpit air from entering the regulator to keep out any toxic fumes which might be present. Also, the "emergency-off" switch provides safety pressure to prevent leakage into the mask. Address: 275 Eric St., Lancaster, N. Y.

The Fireye Explosion Extinguishing System will be installed in the fuel tanks of Lockheed's C-130 Hercules combat transport. The system detects incipient fuel tank fires—such as might be caused by incendiary bullets—and disperses an extinguishing agent in the tank quickly enough to smother an explosion before it can take place. The C-130 also uses the Fireye Aircraft Fire Detection System to monitor the four Allison turboprop engines which power the plane. Manufacturer: Electronics Corporation of America, 1 Memorial Drive, Cambridge 42, Mass.

A compound of synthetic rubber blended with tar is now being laid in a 1½ inch thick wearing surface over 400,000 square yards of parking and maintenance aprons at Hickham Air Force Base, Hawaii to protect the area from the dissolving effects of jet fuels. Called Surfa-Acro-Sealz, the rubber-tar mixture is mixed with stone and applied hot. The paving, made by the Naugatuck Chemical Division, United States Rubber Co., is immune to any hydraulic fluids and lubricating oils, as well as fuel, which may be spilled on the aprons. Surfa-Acro-Sealz has been extensively service tested at Air Force bases in such locations as Florida, Delaware, Maine and Labrador. The Hawaiian installation will use about 70 tank cars of the material.

NEW

VICKERS

Miniaturized

PISTON TYPE HYDRAULIC PUMPS

3000 psi . . . CONSTANT DISPLACEMENT

These new miniaturized hydraulic pumps were developed by Vickers for limited life applications such as missile and ram air turbine driven hydraulic systems . . . also for motorpump assemblies supplying emergency power on aircraft.

A distinctive feature is adaptability to manifolding and special mounting. This permits integration with the balance of a "packaged" hydraulic system to provide hydraulic power in the most compact and lightweight form yet devised. Some sizes are capable of delivering more than five horsepower per pound of weight.

Available in four size series, this miniaturized pump has the same basic characteristics as the standard Vickers piston type pump which has been establishing outstanding performance records on aircraft since 1940. Ask nearest Vickers Aircraft Application Engineer for further information.

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DIVISION OF SPERRY RAND CORPORATION

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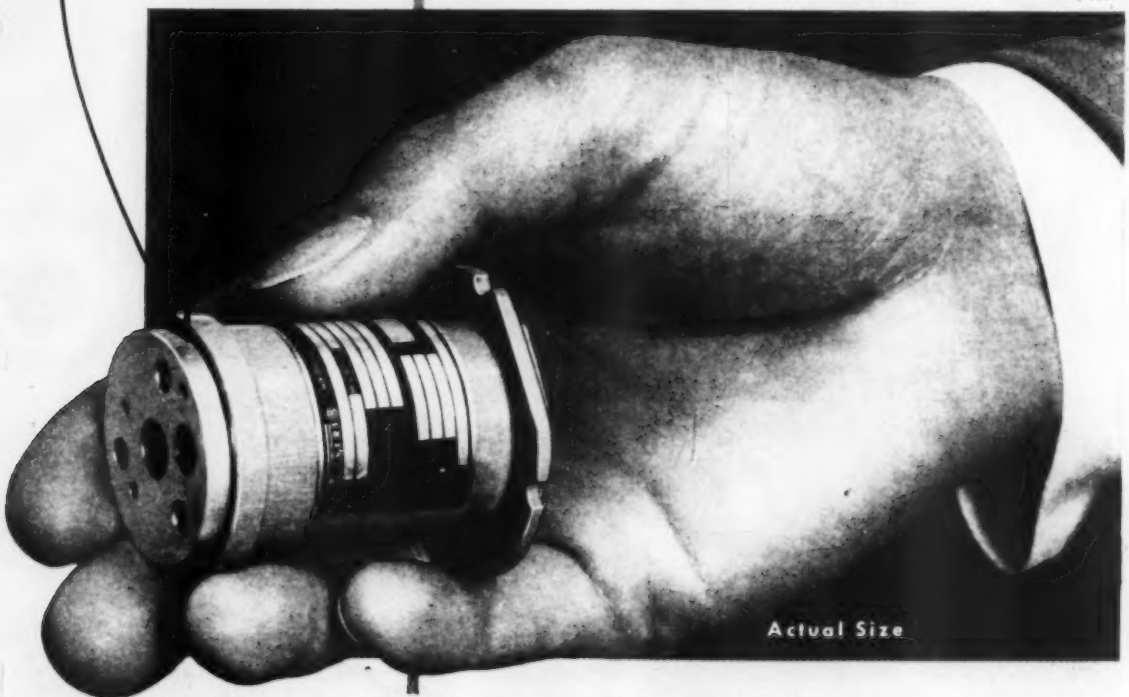
TELEGRAMS: Vickers WUX Detroit • TELETYPE: ROY 1149 CABLE: Videt

OVERSEAS REPRESENTATIVE: The Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middx., England

Engineers and Builders of Oil Hydraulic Equipment Since 1921

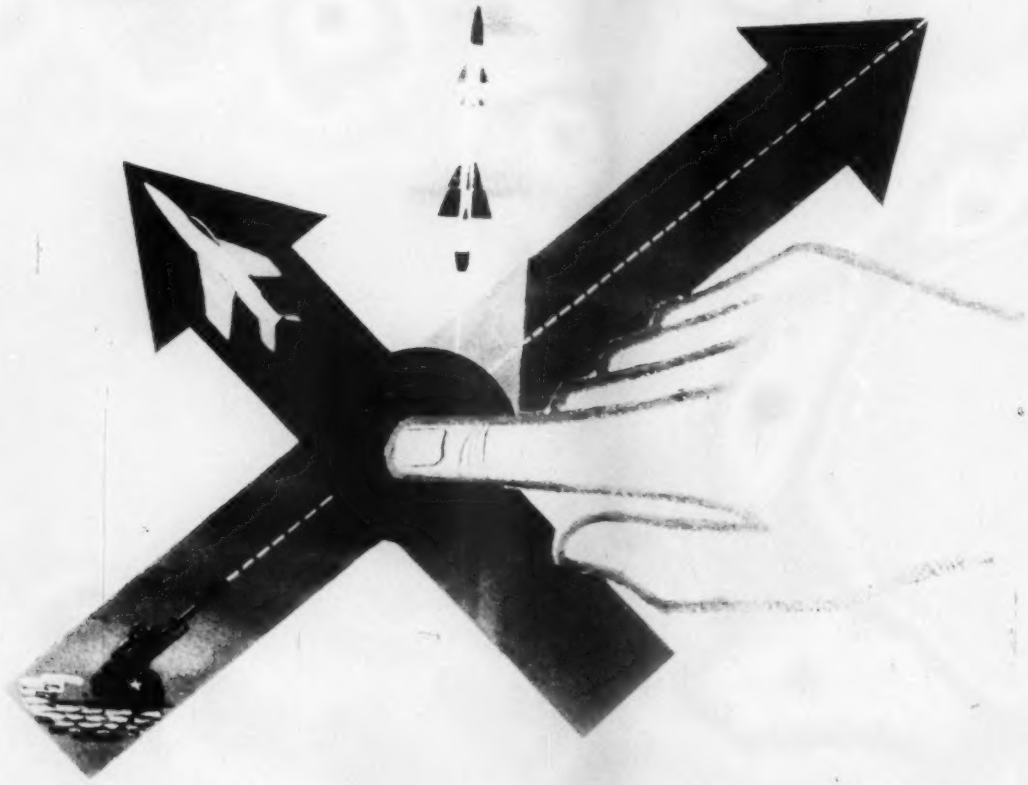
This Hydraulic Pump has 4.3 hp output @ 3000 psi and 12,000 rpm. Weight 0.9 lb.

7469



A large expansion program now in its early stages means large opportunities for additional engineers at Vickers. Write for information.

IBM IN ACTION



HOW DOES AMERICA COME TO "READY ARMS"?

In an age of push-button warfare, turning defense needs into combat-ready realities is no simple matter. America's answer is weapon systems management—a team-up of a broad cross-section of the military and American industry to produce a complete weapon or combination of weapons.

Typical is Project Sage air defense warning and control system—one of the Air Force's most vital projects. This weapon system was conceived in response to an Air Force outline of specific defense problems. The development and production of the computer, heart of the system, were entrusted to IBM.

This involved a dual role. One, building the computers; the other, planning for the complete weapon system. In doing this, the contributions of many, many other companies had to be closely coordinated.

The results? "Ready arms" for America with saved time, effort, expense.

And here at IBM, we are proud of our contribution to weapon systems.

If you are an engineer or technician *interested in electronic assignments as broad and vital as Sage, you'll want to know about the exciting and rewarding opportunities at IBM.* **Write** *to IBM Military Products Division, Department 718-B1, 590 Madison Avenue, New York 22, N. Y.*

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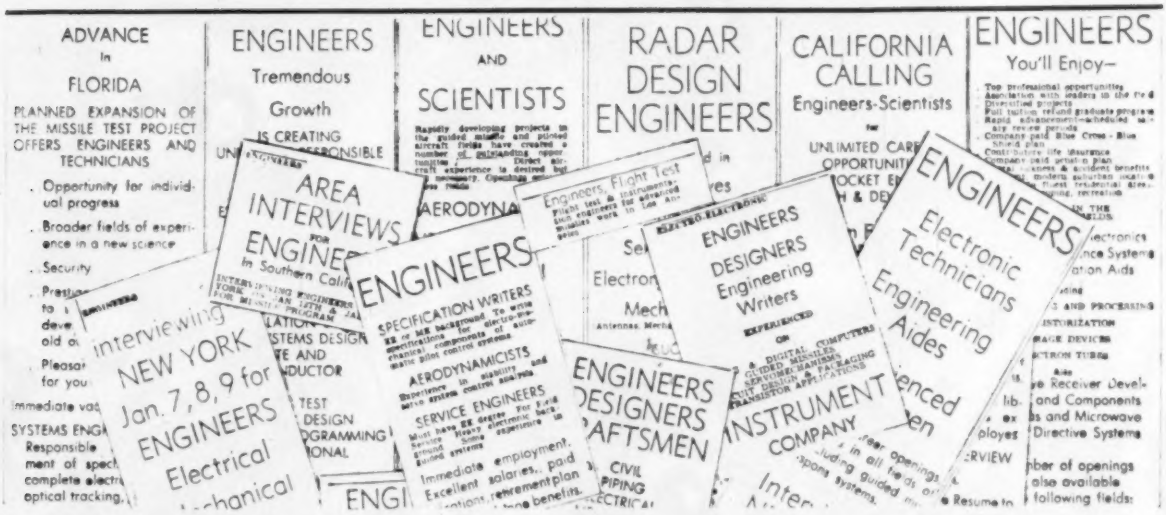

Ads Entice, Replies Rebuff, Survey Finds

By Max A. Pape

There is no legitimate shortage of engineers, judging by the way companies reply to applications for engineering employment.

This is the conclusion of a group of 500 working and student engineers who cooperated in a survey of engineering recruitment techniques.

We analyzed the replies to 105 legitimate resumes submitted to companies advertising for engineers and we ended up confused and discouraged.

We don't feel there is a legitimate shortage of engineers at all, and we base our observation on these facts:

- **Seventeen resumes** were not acknowledged out of the 105 sent to companies all over the U. S.
- **Form letters were received** in reply to 12 of the 105 applications; some of the routine letters were not signed and some not even personalized to the extent of filling in the name and address.
- **Only 23 of the replies** answered a specific question that had been asked in each of the applications. The remaining 53 that responded forwarded application blanks without answering the question, even when that question was about citizenship.
- **Only 14 of the responses** were followed up by another letter, and all 14 were companies in the aircraft industry.

Fifty actual applications for employment were completed and submitted for consideration. Of these 50: 15 were not acknowledged; three asked working engineers (over 5 years' experience each) to take aptitude tests; four prospective employes received follow-through letters written by someone other than the original contact, with no reference made to previous contact or, in fact, to previous correspondence.

Few Tailored Forms

Of the 76 application blanks examined, only seven were especially prepared for engineers. Sixty-eight out of 75 application blanks were inadequate; the wrong questions were asked and not enough space was provided for education, work history, etc.

Of 31 job offers (pending personal interview) three were downright insulting, two cast aspersions on the undergraduate school attended, one cast aspersions on the graduate school.

From this survey have come other complaints and confusions. Large companies with several projects compete for engineers as if they were individual companies. Instead of one overall recruitment coordinator to evaluate and place, we are expected to do our own evaluation.

I wrote to as many as five different projects of the same company, received five different replies, five different salary figures, was offered five different jobs. In some cases I was turned down by four and considered eligible by the fifth.

Had I not had clerical help in making my survey, I would have felt (as 500 interviewed engineers did) that one turndown meant my background was not acceptable to the company in its entirety. This must be as costly for the company as it is frustrating for engineers.

Location Deception

On the other hand, I answered ads placed by large companies spending over a million dollars a year in recruitment advertising. In one case, their strong pitch was that I could select my location and be placed accordingly. My resume elicited a form-letter turndown telling me my resume had been circulated to all company projects. But when I sent copies of that same resume to three projects of that same company, I received three job offers!

Another complaint: applications were sent to specific companies because of

About the Author

Max A. Pape was formerly an ordnance engineer, contract administrator and logistical planner for the U. S. Air Force. While a consultant to the Del Wakeman Co. of San Francisco on engineering problems, he organized a research project to investigate engineering recruitment.

Using authentic backgrounds, names and addresses of three working engineers and two engineering students, Pape answered 30 magazine advertisements and 75 newspaper advertisements for engineers. The ads, replies and the application blanks forwarded with the replies were studied by a group of more than 300 working engineers, more than 200 engineering students, the personnel departments of local companies and representatives of out-of-state companies. Pape interviewed the study group and compiled the results in the paper presented here.

ENGINEERS . . . PHYSICISTS

NEW opportunities at MOTOROLA

YOUR CHOICE OF 3 LOCATIONS

New Motorola research laboratories are expanding, creating outstanding career advantages—your opportunity to get in on the ground floor of a swiftly expanding company. You'll enjoy working in these modern laboratories . . . with liberal employee benefits, including an attractive profit sharing plan. Salary levels are open and commensurate with ability.

POSITIONS AVAILABLE IN: two-way communications • missile electronics • radio & TV (color) • weapons systems • computer application & design • transistor research & production • microwave systems • servo-mechanisms • physical chemistry • metallurgical eng. • field eng. • electronic sales eng. • drafting, design, & layout • aerophysics • radar & military electronics

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Outdoor, relaxed living the year-round, with lots of room to grow (on the job and off) in this land of sunshine.

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write to: Mr. R. Coulter, Dept. G 3102 N. 56th St., Phoenix, Ariz.

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write to: Mr. V. Sorenson, Dept. G
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Planned communities, modern shopping centers, advanced schools, fine buys in homes. There's room to grow and more fun in Riverside.

write to: Mr. C. Koziol, Dept. G Box 2072, Riverside, Calif.

CHICAGO, ILLINOIS

Live a relaxed midwest life in one of the beautiful suburbs, yet have all the "big city" advantages—cultural, social, and educational.

write to: Mr. L. B. Wrenn, Dept. G
4501 Augusta Blvd., Chicago, Ill.

MOTOROLA

their location. On interview we found the job we wanted was in another part of the country entirely. Since location is a strong point in recruitment advertising, what happened to truth in their advertising?

Of the 300 engineers interviewed, more than 200 said they wouldn't answer an ad giving a box number; more than 200 said they wouldn't want to work for a company that stresses its size because they'd get lost in the shuffle.

It was unanimously agreed by 300 engineers and 200 students that, while we enjoy the beautiful brochures, we're not taken in by them. Opinion of a company is based on the way the personnel department handles applications, whether they answer specific questions and whether there is any indication that the personnel department works with the engineering staff.

What Engineers Want

These are the things that are confusing us, the things we don't like. But there are many things we do like—at least 500 of us do—and we are further confused because they aren't being used.

For instance:

- **We like long distance** telephone calls to clear up puzzling questions.
- **We like personal letters** that answer our questions.
- **We'd like our transportation** and expenses for interviews to be paid for in advance, or at least arrangements made with an airline for charge accounts.
- **We like it when companies talk** our language. Of more than 900 ads scrutinized, only three were written by and for engineers.
- **We prefer to work** for companies with engineers in administrative positions because we feel that with engineers in charge there is less chance of waste of engineering talent. Students particularly want to work for an engineer-managed company so they can get around the bugaboo of being held in intern positions. A few companies mention "engineer management" in their ads. Most of them don't.

Other Engineering Lures

We've all had "ne plus ultra" thrown at us from all angles, and of course we're interested in location, climate, housing, good schools, company-sponsored educational programs, etc. But there are other ways we can be lured, and we're surprised that they haven't been tried.

Instead of a large, taxable salary, couldn't we get a small taxable salary, and a large, non-taxable per diem? Couldn't we get company automobiles for private use? Profit sharing? Stock purchase plans with company matching one-for-two, or one-for-ten, or one-for-

The California Division of Lockheed has a special problem. It doesn't limit itself to a few types of planes. It develops virtually all types—cargo and commercial transports, extremely high-speed fighters, radar search planes, jet trainers, patrol bombers and others still classified. And it takes a constant flow of new design ideas to feed this ever-expanding program.

Do you have new ideas? They'll get attention at Lockheed. Your future relationship with us is certainly worth exploring. Perhaps the most convenient method for you to take in contacting us is to write, E. W. Des Lauriers, Manager, Professional Recruiting, or send in the brief résumé form below.

California Division

Lockheed

Aircraft Corporation, Burbank, California

P. S. Aircraft experience is not necessary to join Lockheed. It's your engineering training, experience and ability that count.

E. W. Des Lauriers, Dept. NI-3-1-3
Lockheed Aircraft Corporation
Burbank, California

Dear Sir: Please send me your brochure detailing life and work at Lockheed

Name

If you are an engineer, please state your field of engineering

Home street address

City and State Home phone

100 (depending on market value). Retirement plans are fine, but we feel a really progressive company should tell the world that retirement at 65 is not necessarily automatic. (If a man's profession is in demand, he shouldn't be forced into unwanted leisure).

We'd particularly like to feel that a company's left hand knows what its right hand is doing. In boasting the effectiveness of magazine advertising, companies put in writing: "Received 100 replies to our ad and hired 10 engineers."

Engineers would like to say, "Received 10 concrete offers with a minimum of fuss and accepted one." But we're not always given the opportunity. We're turned down at one project without any reference whatsoever made to another. A home office says "no" and individual projects say "yes;" resumes aren't acknowledged, questions aren't answered, locations are switched on interview.

Of the 500 engineers and students who were interviewed, almost all of them said they'd like to be 10-year-men; they'd like to select the right company the first time and ten years later, be working for the same company in an advanced position. This is only possible if we can shop around carefully before we take job number one. If we can't, we take whatever is offered, and shop around a year or two later, thereby costing the company a great deal more money.

Some Engineers Turn to Unions As Answer to Their Discontent

Engineering unions claim 60,000 members out of the nation's 500,000 engineers, according to a recent study by the National Industrial Conference Board.

To find the seeds of discontent which are driving "unorganizable professionals" into organized trade unions, the board questioned company executives, engineering union officials, engineering societies and individual engineers.

Chief complaints were:

- **Financial** position
- **Professional** status
- **Lack of individual** treatment.

Engineering societies and unions disagreed about the solution to the engineer's problems but, in general, they agreed about what the problems are. The societies say dissatisfaction stems from the disappearance of the personal relationship between engineer and employer and the consequent impersonal treatment of engineers. The solutions they suggest are:

- **Recognition** as part of management team.
- **Less frequent** assignment to jobs requiring little engineering ability.
- **Classification** with professionals rather than non-professionals.

The engineering societies believe unionism is incompatible with the engineer's professional status. They point out that employers can improve employment standards.

The unions believe that unionism is an answer which offers specific solutions to the engineer's problems. They report that engineers are joining unions to regain lost professional status.

A widely reported complaint by engineers is that the income differential between engineers and hourly wage earners is disappearing. One of the most important reasons for this is that the latter are organized.

A somewhat similar complaint is that the income gradient between newly hired engineers and experienced engineers is not steep enough.

This is because the frenzied competition for engineering graduates leads companies to offer attractive starting salaries taken from money which would ordinarily go for pay raises. Highly colored advertisements for engineering help by aircraft companies are blamed for making engineers discontent with their present jobs.

In its report the board outlined the background and extent of engineering unionization. It listed three types of unions which engineers are joining.

- **Independent professional** unions such as the Engineers and Scientists of America. These unions claim 30,000 members.
- **Semi-professional** unions such as the American Federation of Technical Engineers, AFL-CIO. They claim over 15,000 members.
- **Production workers'** unions such as United Automobile Workers, United Steel Workers and the International Union of Electrical Workers. They claim a substantial number of professional caliber engineers.

Air Kruise Starts Combination Service

London—A new combined bus, air and rail service linking England with France, Spain and Italy has been announced by Air Kruise, an independent British carrier.

Known as the Blue Arrow, the service is to start in the spring.

Passengers will travel by bus from

To the ENGINEER of high ability

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Among them are:

air-conditioning

pressurization

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The Garrett Corporation is also applying this engineering skill to the vitally important missile system fields, and has made important advances in prime engine development and in design of turbochargers and other industrial products.

Our engineers work on the very frontiers of present day scientific knowledge. We need your creative talents and offer you the opportunity to progress by making full use of your scientific ability. Positions are now open for aerodynamicists ... mechanical engineers ... mathematicians ... specialists in engineering mechanics ... electrical engineers ... electronics engineers. For further information regarding opportunities in the Los Angeles, Phoenix and New York areas, write today, including a resumé of your education and experience. Address Mr. G. D. Bradley

THE GARRETT CORPORATION

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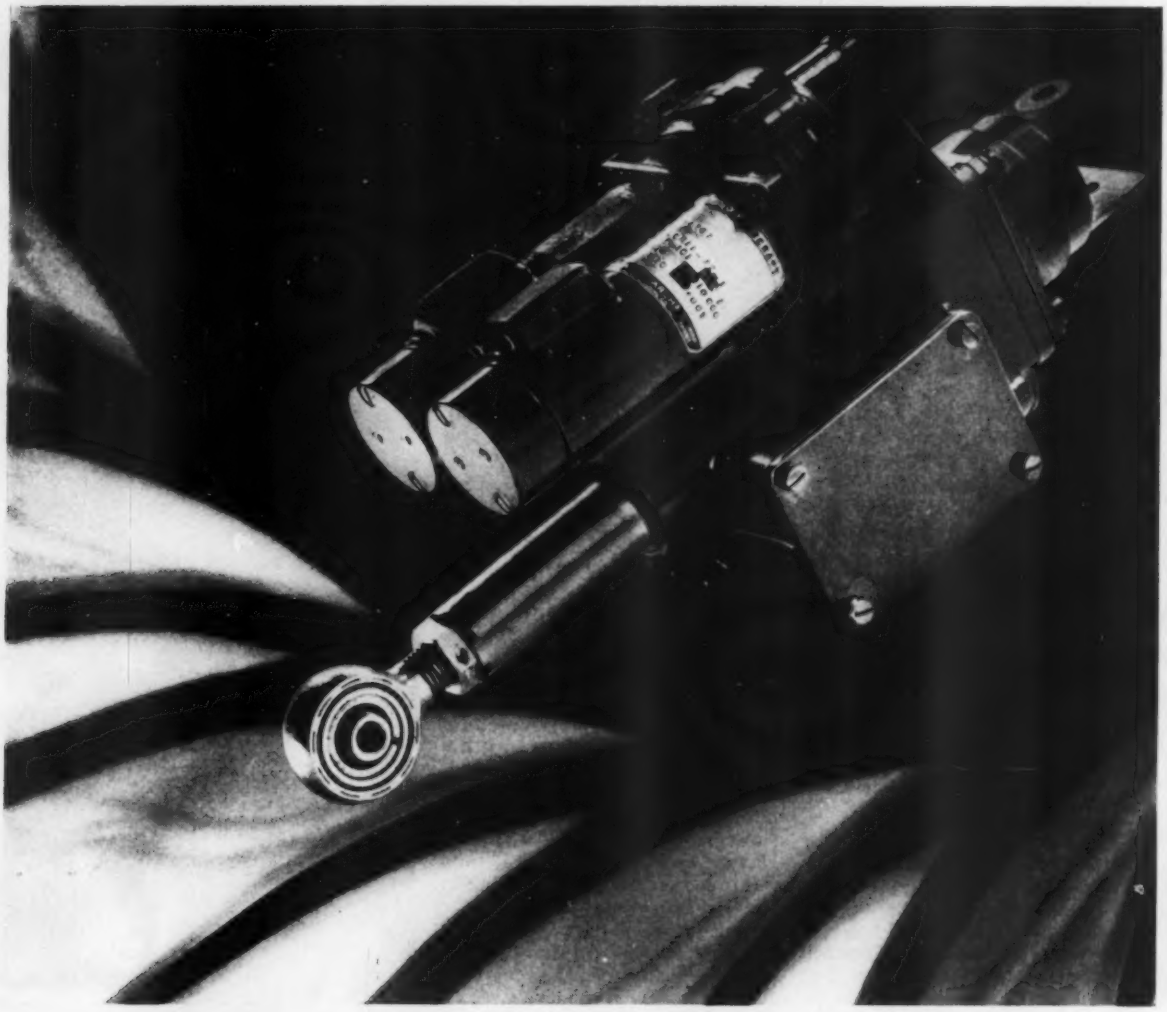

Four-speed actuator

AiResearch two-motored unit provides automatic control plus an instantaneous manual override at the work end of its Air Data System

During high-speed flight, where control is so delicate it is often by trim surfaces alone, immediate response under emergency conditions is of critical importance. The actuator shown allows immediate pilot override of the automatic system without any disconnect activity or mechanical clutching device. If necessary any one of four speeds may be instantaneously selected. The unit operates with complete dependability at ambient temperatures up to 300°F.

AiResearch actuators operate on split-field or permanent magnet DC motors, on AC servo motors or on single-phase, two-phase or three-phase AC motors. They can supply feedback signals to the control and be provided with neutral positioning and light-switches.

We are now engaged in the development of Air Data Systems of all types, assuming full system responsibility. Because we manufacture the entire system, including transducers, computers and actuators, you are assured of the utmost in system compatibility.

Outstanding opportunities for qualified engineers. Write for information.

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Los Angeles 45, California • Phoenix, Arizona

Designers and manufacturers of aircraft systems and components: REFRIGERATION SYSTEMS • PNEUMATIC VALVES AND CONTROLS • TEMPERATURE CONTROLS CABIN AIR COMPRESSORS • TURBINE MOTORS • GAS TURBINE ENGINES • CABIN PRESSURE CONTROLS • HEAT TRANSFER EQUIPMENT • ELECTRO-MECHANICAL EQUIPMENT • ELECTRONIC COMPUTERS AND CONTROLS

The 20th Century's most challenging opportunity for the creative engineer...

Automatic Control Systems

for tomorrow's needs and hypersonic speeds

Ten years ago—when AUTONETICS began its work—miles-per-hour thinking had to be abandoned. The task of developing guidance and control systems for the Air Force SM-64 NAVAHO Intercontinental Missile demanded engineers who could design, manufacture, test and *produce in quantity* automatic controls that would operate in environments and at speeds never before experienced.

Today—because of its proved ability to convert ideas into engineering fact—AUTONETICS is one of the few organizations in the world with a unique stockpile of experience in information processing, inertial navigation, flight controls, armament control systems, computers and other automatic control systems.

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The projects we are pursuing at AUTONETICS call for extremes in mindpower and environmental facilities.

We have the facilities... among them a new Autonavigation building where each cubic inch of air contains fewer than 6 dust particles... where temperature variation is held to plus or minus 1°.

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you have knowledge, enthusiasm and imagination—tempered with judgment. You're both research and production-minded—a dreamer and a doer at the same time. At every level of experience, you'll have an opportunity to conceive and activate an idea. Then prove it—a better way!

And you'll do it in a management climate that stimulates personal growth—and rewards it with the responsibility, professional recognition and material benefits limited only by your own ability. Your own academic stature can be constantly enlarged by our Educational Refund Plan...and some of the nation's finest universities are nearby.

Write today for full particulars. If you're the man we're seeking we'll be glad to arrange a personal interview where you are now residing.

Write: Mr. A. Brunetti, Autonetics Engineering Personnel, Dept. 911, 1-AW, Box AN, Bellflower, Calif.

ADVANCEMENT IS RAPID WHERE GROWTH IS RAPID

Chief Engineer Robert Ashby, 44, is one of our nation's top electronics scientists. He holds AB and MA degrees in Physics from Brigham Young, a Ph.D. in Physics from the University of Wisconsin. His hobbies are Southern California year-round "naturals"—golf and swimming.

Lester Kilpatrick received his BSEE from Texas Tech in 1946, his MSEE from M.I.T. two years later. During 8 years at North American, he has earned a national reputation as an authority on digital computers. With his wife and 4 year old son, he likes to spend week ends "at the beach."

Navy vet E. A. O'Hern joined Autonetics in 1951 after earning his BS, MS and Ph.D. from Purdue University. A Research Supervisor, he has developed advanced techniques for analysis of autopilot-controlled flexible airborne vehicles. His hobbies include baseball, basketball and music.

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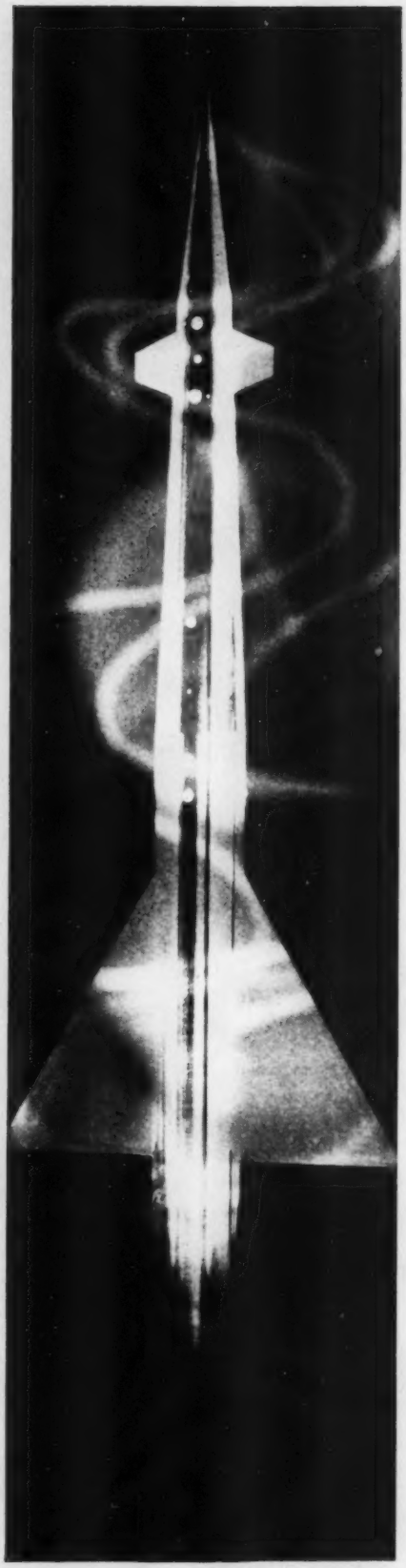
AUTOMATIC CONTROLS MAN HAS NEVER BUILT BEFORE



Model 12-C in Australia

Hiller Model 12-C helicopter attracts considerable attention from aboriginal children on its first visit to Australia's Cape York Peninsula. Copter belongs to Trans-Australia Airlines and was chartered for mineral search work (bauxite). Photo was taken at a mission station on the distant Cape.

London to Ferryfield, by air from Ferryfield to Lyons, France, and then to their destination by rail. A trip to Nice, for example, will take 12 hr. at a round-trip fare of 56 dollars.

A similar service by Silver City Airways link London with Brussels and Paris.

Helicopter Pool for Australia Suggested

Melbourne—The Australian subsidiary of Bristol Acroplane Company has submitted a scheme to create a special helicopter pool to meet emergency and national development requirements in Australia.

The detailed scheme was submitted to federal and state governments. Bristol is suggesting an initial purchase of six Bristol Sycamore or similar helicopters to be used in air-sea rescues, anti-flood work, bush fire control as well as national survey and developmental work.

The report suggests that the scheme should be managed by armed services or airline companies.

Also suggested is a "national air guard" to man the helicopters with personnel contributions from armed services.

It is believed the federal government is unlikely to consider the scheme in the near future, although the success obtained by airline operators with their experimental helicopters will lead to additional foreign orders in 1957, and the government will sanction the new purchases and allocate foreign exchange.

Barougan in Algiers

Modified French air force Dassault Ouragan, which the French call "Barougan," lands at Telergma Air Base in Algeria with tail chute. The Barougan is equipped with dual-type low pressure tires and the tail chute for getting in and out of rough fields. It has four 20 mm. cannons and can carry two 500 lb. bombs or eight rockets.

ENGINEERS

Aerodynamics & Propulsion

APL-An Organization Of And For Technical Men And Scientists

The Applied Physics Laboratory, (APL) of the Johns Hopkins University is an organization of and for technical men and scientists. APL is organized on a horizonal basis; responsibility and authority are given in equal measure. Scientists and technical men occupy all decision-making positions, because our only objective is technical progress.

Because of its predominantly professional character, APL has kept in the vanguard, having pioneered the proximity fuze, the first supersonic ramjet engine, the Navy's Bumblebee family of missiles which includes the TERRIER, TALOS and TARTAR, and is presently attempting break-throughs on several important fronts.

Occupying a site equidistant from Washington, D. C. and Baltimore, Maryland, APL's new laboratories allow staff members to select urban, suburban or rural living, and either of these outstanding centers of culture as a focal point for fine living. Salaries compare favorably with those of other R & D organizations.

OPENINGS EXIST IN:

DEVELOPMENT: Stability and control analysis; ramjet engine design; preliminary design and wind-tunnel testing.

RESEARCH: Interference and heat transfer phenomena; internal aerodynamics; hypersonics, turbulence, shock wave phenomena; combustion.

Write for complete information. Your letter will be answered personally, in detail.

Write: Professional Staff Appointments

The Johns Hopkins University
Applied Physics Laboratory

8615 Georgia Avenue, Silver Spring, Md.

WHAT'S NEW

Publications Received:

"The Aeroplane" Pictorial Review—by the Staff of "The Aeroplane"—Pub. by Temple Press Ltd., Bowling Green Lane, London, E.C. 1, England. Approx. $1.05.

Two-hundred and eighty of the best photographs that "The Aeroplane" has published during the past year are collected with text to present a unique pictorial review of the aeronautical scene.

Sectional Properties of the Circular Fractions—by Monroe Ames—Pub. by Exposition Press, Inc., 386 Fourth Avenue, New York 16, New York. $5.00; 27pp.

A handbook for aeronautical, structural, and mechanical engineers containing tables which show the values for every five degrees of arc for the three figures which can be designated circular fractions: the sector, the segment, and the fillet.

Three-Dimensional Flow in Axial-Flow Turbomachinery—by L. H. Smith, Jr.—Available from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., order PB 121489, $.50; 14pp.

This is Volume II in the series showing means of prescribing blade shapes to give the desired flow distributions in axial-flow turbomachinery. Volume I (PB 121052), 140pp., $3.50, is still available from OTS.

Civil Air Regulations in Plain English for All Pilots—by Sam R. Hamilton—Pub. by T. S. Denison & Company, 321 Fifth Avenue So., Minneapolis 15, Minnesota. $3.00; 95pp.

Specifically directed to the needs of airplane pilots, student, private, and commercial, this book is not a reprint but a detailed explanation of the visual flight rules that have been established by the Civil Aeronautics Administration.

Ryerson Steel Data—Prepared by Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill., and available from this address at no charge. 256pp.

The revised edition of this pocket-size data book gives helpful information on machining and fabricating, specifications and tolerances, weights and dimensions, elements and safe loads.

"Proceedings of the RETMA Symposium on Reliable Applications of Electron Tubes"—Pub. by Engineering Publishers, GPO Box 1151, New York 1, New York. $5.00; 105pp.

Nineteen experts present papers and discussions on such subjects as "Keyed Phase-Sensitive Demodulator," "Design of a Reliable Flip-Flop," and "Series String Applications."

Flying Clubs Do Pay Off—by Jim Ottney, Peg Williams, and Ernie Stadvec—Available from ESSCO, 1654 Idlewood Avenue, Akron 13, Ohio. $1.00; 20pp.

Based on the experience of one of its authors, this booklet is a complete guide to the formation and operation of flying clubs.

ASTM Standards on Zinc-Coated Iron and Steel Products—Sponsored by ASTM Committee A-5 On Corrosion of Iron and Steel—Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia, Pennsylvania. $2.25. 136pp.

This publication is intended primarily to present in a convenient form for reference the various ASTM standards and tentative methods for test and specifications pertaining to metallic coated iron and steel products.

Manual of Consulting Practice for Mechanical Engineers—Prepared by the Committee on Professional Practice of Consulting Engineering of the American Society of Mechanical Engineers

AERONAUTICAL

INTERESTING APPLICATIONS IN FLIGHT RESEARCH OF WORLD FAMOUS SPERRY EQUIPMENT

ENGINEERING TEST PILOT

with recent jet fighter or 4 engine experience. Engineering degree, and 2500 hours minimum flying time required.

UTILITY PILOT

Commercial and instrument ratings required. Minimum of 2500 hours first pilot time. Seaplane rating desirable.

FULL EMPLOYEE BENEFITS
RELOCATION ALLOWANCES

APPLY TO MR. R. STEWART

SPERRY GYROSCOPE CO.

Division of Sperry Rand Corp.

MacArthur Field
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McDonnell Demons Refuel Aloft

First test of new in-flight "buddy" refueling system developed by Beech Aircraft Corp. for McDonnell Aircraft Corp. is shown near St. Louis. For refueling of modern jet fighters at high speeds and altitudes, unit under F3H-2N fuselage is 22-ft. long externally mounted tank equipped with a self-contained hydraulic system capable of pumping fuel at a rate of 200 gal. per min. Fuel is transferred through a flexible steel hose which trails some 50 ft. behind the tank. Hose was developed and built by Aircraft Components Division, Dunbar Kapple, Inc., Batavia, Ill. It's a flexible convoluted thin-wall stainless steel tube reinforced with a sheet of braided wire, designed to be wrapped within tank, yet offering minimum flow restriction. Navy's "buddy" concept of inflight refueling was exclusively revealed by Aviation Week (Mar. 14, 1955, p. 88).

and available from ASME Order Department, 29 West 39th Street, New York 18, New York. $1.50; 14pp.

Pioneer Educator in the Air Age—Prepared by the Daniel Guggenheim School of Aeronautics, New York University, College of Engineering, University Heights 53, New York. 59pp.

Commemorating the 30th anniversary of the Guggenheim School of Aeronautics, this booklet presents an entertaining and informative history of its development.

1956 Supplements to Book of ASTM Standards—Pub. by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. In seven parts, $4.00 each; $28.00 for the set of seven which are as follows:

Part 1. Ferrous Metals—440pp.

Part 2. Non-Ferrous Metals—360pp.

Part 3. Cement, Concrete, Ceramics, Thermal Insulation, Road Materials, Waterproofing, and Soils—300pp.

Part 4. Paint, Naval Stores, Woods, Sandwich Construction, Building Constructions, Fire Tests, Wax Polishes—230pp.

Part 5. Fuels, Petroleum, Aromatic Hydrocarbons, Engine Antifreezes—320pp.

Part 6. Rubber, Plastics, Electrical Insulating Materials—380pp.

Part 7. Textiles, Soap, Water, Paper, Adhesives, Shipping Containers, Atmospheric Analysis—220pp.

The IATA Facilitation Policy Manual—Issued by the International Air Transport Association, Terminal Centre Building, Montreal 3, Canada. 250pp.

Being distributed to the facilitation personnel of IATA member companies, the manual is a world wide reference on ways to cut back red tape regulations affecting passengers, shippers and airlines alike.

Techniques for Making and Projecting Stereoscopic Slides—by C. W. Kendal and W. H. Richards—Available from OTS, U. S. Department of Commerce, Washington 25, D. C., order PB 121-282, $1.00; 35pp.

Alignment Testing—by K. J. Hume—Pub. by Engis Equipment Co., 431 South Dearborn Street, Chicago 5, Illinois. 8pp.

Patent Notes for Engineers—by C. D. Tuska—Pub. by McGraw-Hill Book Co., 330 West 42nd Street, New York 36, New York. $4.00; 192pp.

Proceedings of the High Temperature Symposium Sponsored by the University of California and Stanford Research Institute—Available from the Public Relations Department, Stanford Research Institute, Menlo Park, California. $5.00; 218pp.

Thunderbirds—by Jack Williams—Pub. by Republic Aviation Corp., Farmingdale, Long Island, N. Y.

The story of the origin and operations of the USAF's 3600th Air Demonstration team known throughout the world as the Thunderbirds, one of the finest precision flying teams in the history of aviation. Written by the son of Marine Corps Major "Al" Williams, this privately published volume is well illustrated with flight and ground pictures and diagrams detailing the Thunderbirds maneuvers with their Republic-built straight and sweptwing F-84 aircraft.

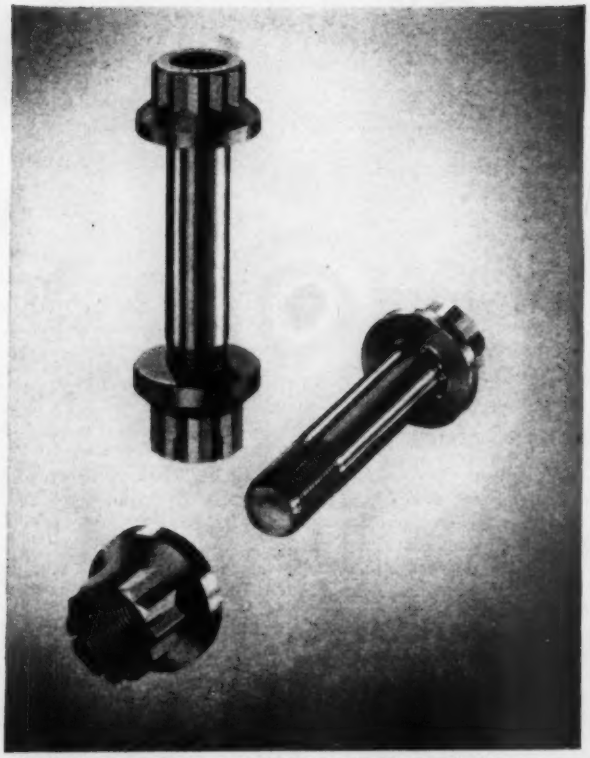
"High Temperature—A Tool for the Future"—Pub. by Stanford Research Institute, Menlo Park, Calif. Available from the Public Relations Department of Stanford Research Institute, Menlo Park, Calif. $5.00 postpaid; 218pp.

The High Temperature Symposium was jointly sponsored by Stanford Research Institute and the University of California. The three-day meeting, held on the campus at Berkeley, June 25, 26, and 27, attracted approximately 600 delegates from throughout the United States and several foreign countries. The conference dealt more broadly with the different phases of high temperature research than any previous conference.

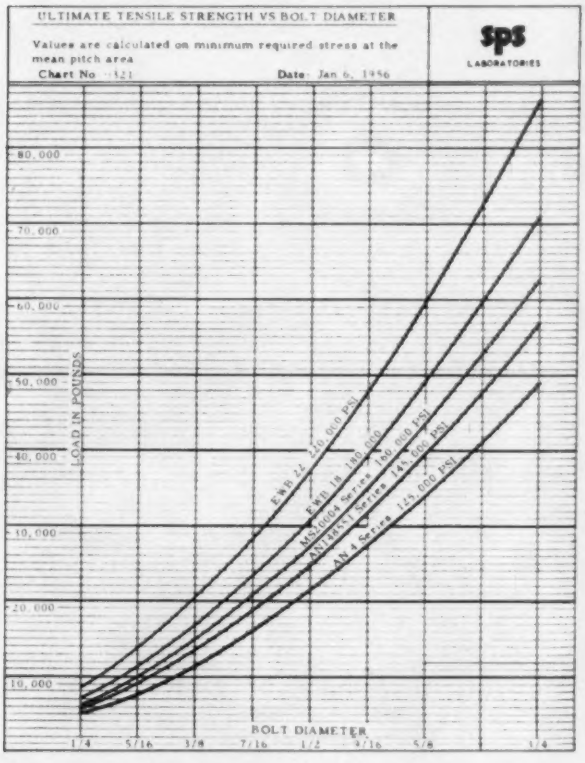
Some 36 speakers participated in the three major categories of discussion—namely, methods of reaching high temperatures, materials suitable for high temperature use, and processes occurring at high temperature.

ASTM Methods for Chemical Analysis of Metals—Pub. by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. $8.00, cloth cover; 640pp.

The 1956 edition of this book is the first complete revision of the volume since 1950. It is essentially a part of the Book of ASTM Standards and contains all ASTM methods for chemical analysis of ferrous and non-ferrous metals and alloys.



EWB-22 bolt is entirely new. External wrenching head with increased bearing area permits greater loading without indentation of bolted surface. New Hi R thread form, generous fillet under head, smooth overall surface increase tensile and fatigue strength. The EWN-22 locknut was designed with characteristics specially suited to the bolt.



Build stronger, safer, lighter airframes with new SPS Hi Psi aircraft bolts

Conventional bolts were not strong enough to fasten jet-age aircraft now on drawing boards. So Standard Pressed Steel Co. discarded obsolete fastener configurations, materials and production techniques and designed a new high-strength bolt—the Hi Psi EWB-22—which is the strongest bolt made to this time.

Compared with conventional 160,000 psi bolts like the MS 20004 Series, the SPS EWB-22 has 38% greater tensile strength and, at 8 million stress cycles, up to 90% greater fatigue strength. These qualities make it feasible, in most cases, to replace a standard MS 20004 Series bolt with an EWB-22 *of the next smaller diameter*. The benefits from use of the EWB-22—in increased structural strength and security and in reduced weight—are obvious.

Concurrently with the development of the EWB-22, SPS produced the Hi Psi EWN-22 locknut to complement the bolt. It is a high tensile strength self-locking nut with a 12-point external wrenching surface. It makes possible the high wrenching torque needed to preload the EWB-22 to the greatest advantage.

Along with Hi Psi EWB-22 bolts and EWN-22 locknuts come other new additions to the complete SPS line of threaded aircraft fasteners—PLI-22 preload indicating washers, simple mechanical devices for accurately preloading the new high strength bolts. For detailed information about these products—or about your special aircraft threaded fastener problem—write us today. Aircraft Products Division, STANDARD PRESSED STEEL CO., Jenkintown 3, Pa.

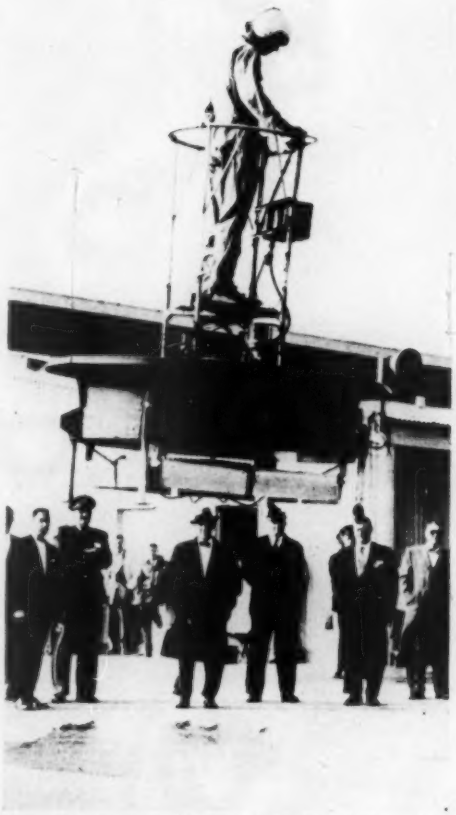
AIRCRAFT PRODUCTS DIVISION

STANDARD PRESSED STEEL CO.

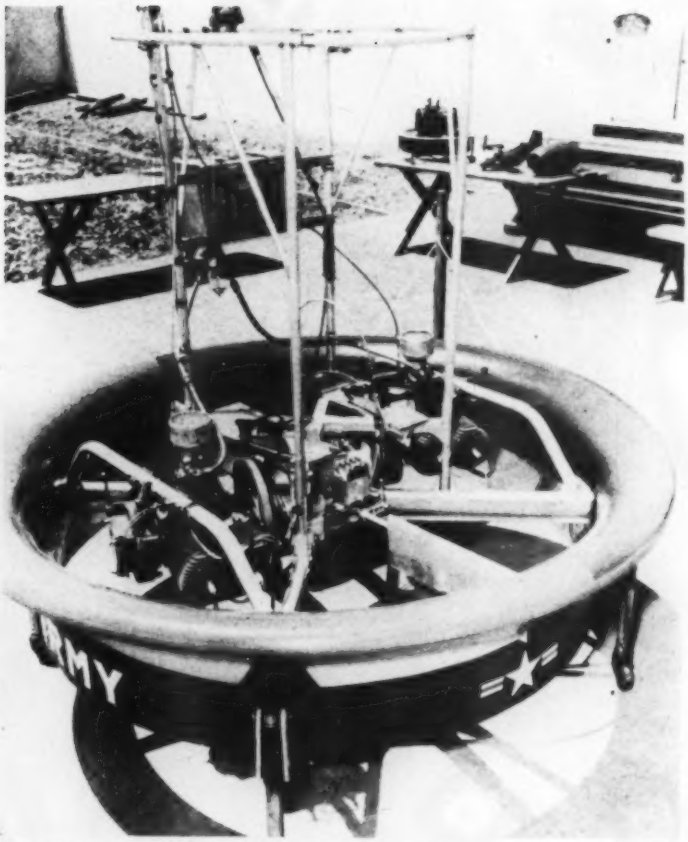
SPS

JENKINTOWN PENNSYLVANIA

EWB-22 is much stronger than conventional aircraft bolts. These curves, with ultimate tensile strength in pounds plotted against bolt diameter, show that it is feasible to replace an MS 20004 bolt with an EWB-22 one size smaller. The EWB-22 is stronger in shear and in fatigue as well.



THE THREE-ENGINED Hiller Flying Platform has spider-connected control surfaces hung under shroud.

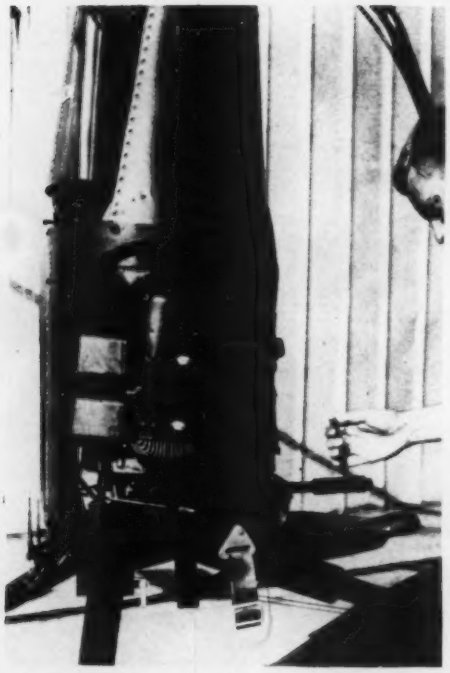


COAXIAL fans are belt-driven by 44 hp. two-cycle engines offset to reduce phasing of engine shaft vibrations. Vertical surfaces inside shroud are directional controls.

New Hiller Flying Platform

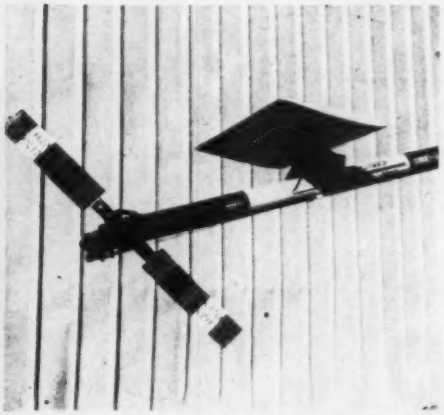
A three-engined flying platform prototype has been built by Hiller Helicopters under a $500,831 contract for the Army. Most obvious advance from the earlier twin-engined version backed by the Office of Naval Research is a ring of airfoil segments mounted below the fan shroud. These appear to be ganged together by a rigid spider. Plans to use the flying platform as a troop and supply carrier would make it impractical to continue relying on weight shifting as a means of translational control. Deflection of downwash by the new airfoils may provide a substitute. The pilot platform of the three-engined version is located higher above the fan and shroud. It retains the bungee cord shock absorbers of the earlier model.

OPERATIONAL design would carry four seated men. Translational control by shifting pilot's weight is impossible and may explain control surfaces below shroud (above left).



ROTORCYCLE is started with pull-cord. Pilot sits on a bicycle-type saddle.

HILLER XROE-1 Rotocycle can be unpacked and assembled in 10 minutes. Marines would use it for battlefield liaison and small unit tactical maneuvers.



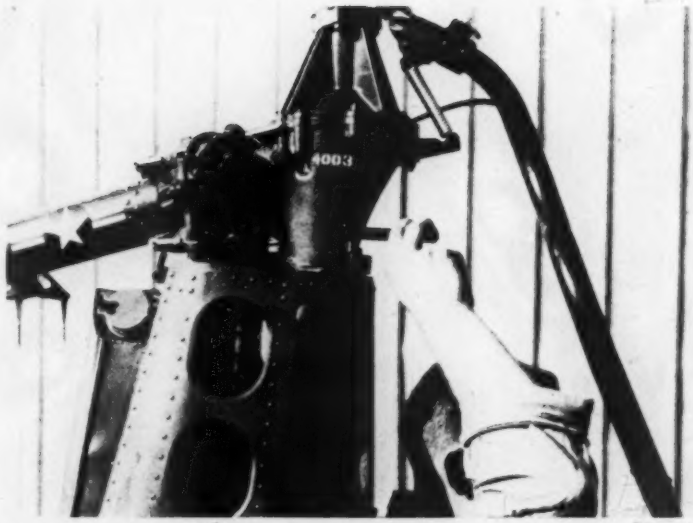
TAIL ROTOR of XROE-1 is cable controlled. Horizontal stabilizer may be ground adjustable.

Battlefield Entry for Navy-Marines

Hiller XROE-1 entry in the Navy-Marine Corps design competition for a one-man battlefield transportation and liaison helicopter can be assembled in 10 minutes in the field. This is made possible by using quick release pins to assemble the sections into which the helicopter is broken for transport. About nine pins are used for this purpose. They are chained to the appropriate sections to prevent their being lost.

The XROE-1 is a conventional configuration with a single two-bladed 18-ft. main rotor and a tail rotor for directional control and stability. A small servo-rotor provides power for pitch control of the main blades and prevents feedback of forces from the rotor to the control system. The tubular tail boom and the load-bearing pylon behind the pilot are of formed and riveted sheet construction designed for low cost production. A horizontal surface above the tail boom provides extra longitudinal stability in cruising flight and may be used as a ground adjustable trim surface.

Wheel-less tripod landing gear are easy to produce, maintain and transport but eliminate the possibility of take-offs and landings with some translational speed. This would limit the altitude of the bases from which the XROE-1 could operate as translational speed provides extra lift. It is reasonable to assume that a wheeled version is being considered to correct this shortcoming.



HAND-OPERATED clutch engages rotor of tiny copter. Probably a friction clutch is used to bring the rotor up to engine speed after which a jaw clutch is engaged.

ABOUT nine quick release pins are used to assemble the packageable sections of the Rotorcycle structure. Copter is designed to be dropped to field units by parachute.

Assembled in 10 Minutes

The XROE-1 weighs less than 250 lb. and is intended to carry a 180 lb. man with a 60 lb. pack. It is powered by a Nelson four cylinder, in-line opposed, two-cycle, air-cooled gasoline engine manufactured by Barmotive Products. The same engine is used in its lone competitor, the Gyrodyne XRON-1 (AW Aug. 20, 1956; p. 64) coaxial rotor design. It was originally designed as an engine for powered gliders. Gyrodyne is known to be seeking a more powerful unit despite the theoretical 10% load lifting advantage of coaxial configurations. In one of the two prototypes, fuel is stored in a spherical cell above the tail boom. Shape of the cell indicates that it may be pressurized to eliminate need for a fuel pump.

Richard L. Peck, test pilot of the XROE-1, reports that it is stable by helicopter standards and easy to fly. This is essential to its mission of battlefield transportation, reconnaissance and communication. Relatively large numbers of troops must be taught to fly it quickly and cheaply. Builders of both entries in the BuAer competition predict that Marines will be able to fly their aircraft with less than four hours of instruction. The pilot's seat is shaped somewhat like a bicycle seat, indicating that the copter is not intended for long missions.

Hiller Expansion Due To New R&D Work

Hiller Helicopters is predicting a continuation in 1957 of the 40-60 ratio of research and development work to production which was established in 1956, and which has played a large part in the company's expansion.

Leading R&D projects at Hiller's Palo Alto, Calif. plant are:

- **A tilting wing,** turboprop VTOL transport for USAF.
- **Further development** of the ducted fan-flying platform vehicle for the Army. Stability and control systems for load carrying versions should draw special attention.

A three-engined version is now flying which will hover at 3,000 ft.

- **An Air Force** backed retractable rotor convertiplane.
- **"Circulation lift aircraft"** such as the Karman-Yuan airfoil are being discussed.

While Hiller's R&D work has been largely responsible for the company's recent expansion, approximately 60% of last year's $10 million gross came from production.

In 1957, helicopter production will be centered around the H-23C and, beginning in the fall, the H-23D. The latter version incorporates a simplified transmission intended to increase time between overhauls to 1,000 hr. This is in line with the Army drive to increase availability and reliability of its helicopter fleet.

Executive Vice President Edward Bolton reports that the company hopes to diversify by taking on sub-contracts for close tolerance work in the missile and high speed aircraft fields.

Financially, the company is unusual in the helicopter industry because it is 70% privately owned and 30% government owned. Industry average is exactly reversed.

Hiller recovery has been steady since 1953, when it almost went out of business, to its present strong position in the industry.

It is the third largest producer of helicopters, working on 14 research and development projects under some 25 contracts, with a 1956 gross of about $10 million and a backlog of almost $15 million.

Recently, as President Stanley Hiller put it, the company has suddenly

Eleven low-noise G-E tubes help Republic test planes for absence of radio interference!

With the aid of 11 General Electric GL-6299 low-noise, high-gain triodes, Republic Aviation Corporation saves time and costs when monitoring fighter planes for radio interference.

The compact, 1-inch-long tubes are installed in the sensitive SPA-224 Noise Interference Analyzer developed jointly by Applied Research Inc., Flushing, N. Y., and Republic. Using this analyzer, quality-control engineers activate one-by-one the electrical components of a plane, then read an oscilloscope to learn if there is any noise interaction with radio receiver, radio compass, or other electronic unit.

Since the analyzer operates continuously from 225 to 400 megacycles, monitoring covers some 20 frequencies at once. Formerly each frequency called for its own job of monitoring. Time saved by Applied Research Inc.'s new method is such that one hour's testing at Republic now accomplishes what before took a whole day!

The low-noise figure of the GL-6299—under 5 db in 225-to-400-mc service—can give new capabilities to your equipment for testing, communications, air-navigation, radar, or other purpose. Ask a G-E tube engineer to check your new circuit for application possibilities! *General Electric Company, Electronic Components Division, Schenectady 5, N. Y.*

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"squirted out" in all directions in the VTO field.

In 1953, after the Korean war boom, the company was almost forced out of business. It was losing money, was down to a three-months' backlog on the one "substandard" (it had been adapted for the military on a rush basis) product they were making, the H-23A helicopter. In a management crisis, Hiller came within one vote on the board of directors of losing control.

The company was under-financed, had inadequate production facilities—subcontracted 90% of its work—had let out 300 people, was ready to let another 500 go.

Without the acceptance by the military that would insure contracts to keep it alive through peacetime, Hiller Helicopters had to make major changes in its philosophy and operations if it was to survive.

Owing its success to date to its pioneer work in VTO, the company decided to pioneer again, but to diversify its exploration. Hiller helicopters selected three VTO areas to explore: ducted fans, tilt-wing propelloplane and new versions of their basic product, the helicopter.

At the same time that the company started sending out "exploring parties" into new areas, it set about tightening up its home base operation, rebuilding and strengthening its management team, improving its financial position, expanding its production facilities.

To implement this program the company in 1955 established a separate division for advanced research, heading it up with Frank A. Heileman, Maj. Gen., U.S. Army (ret.) and formerly Chief of Transportation, Department of the Army. A new 10,000-sq. ft. building adjacent to the main plant houses a complete laboratory and shop for construction of experimental projects.

While Hiller's strides in R&D have kicked off its strong expansion, the company is still primarily a production company. Its $10 million gross last year was split 40-60 to R&D.

Currently it is building the three-place H-23C, used for training, mapping and reconnaissance by the Army and National Guard. Its commercial counterpart, the Hiller 12C, is used by private operators around the world.

It expects to maintain the production—R&D ratio next year, building volume in both. Important in 1957 production will be the H-23D, which Hiller expects to start turning out next fall.

This is the first helicopter designed under the Army concept of lowering operating costs by extending major overhaul periods. The "D" will have a Lycoming 250-hp. engine and a completely new transmission system and is designed for 1,000 hours service between overhauls.

Executive Vice President Edward Bolton notes, "We hope to achieve diversification as products now in the R&D stage are ordered in quantity. Also, we are currently seeking subcontract work for high tolerance parts required in missiles and high speed aircraft."

Hiller has accomplished the 70-30 ownership ratio by a faithful reinvestment of earnings; the company has never paid a dividend and most stockholders have been content with building their equity.

The company has built towards becoming an integrated plant until now it has some 180,000-sq. ft. of space and does 65% of its own work, keeping subcontracting at a minimum. Hiller feels that this move was essential for survival of a small company in this brutally competitive field. He wanted the plant to be as flexible as possible, so that under minimum business conditions they can keep their work in their own plant, keep their employes working. The company, for instance, builds its own metal blades, blows its own canopies for the H-23 and H-32, has made the plastics industry take notice of its fiberglass work in both structural and non-structural parts.

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SERVICE CEILING of the E50, with its supercharged Lycomings, is 24,800 ft. Large transparent area makes for good visibility.

Aviation Week Check Ride:

New Twin-Bonanza Is Smooth and Swift

By Robert Stanfield

New York—Beech aircraft's new six-seven place E50 Twin-Bonanza is a smooth-handling, swift, top-performance aircraft geared to high-altitude, over-the-weather flight.

Flight evaluation by AVIATION WEEK showed that E50 matched or exceeded Beech performance and specification figures for all phases checked.

Model E50 incorporates two Lycoming GSO480-A1A6 horizontally opposed, six-cylinder supercharged engines. A1A6s, each of 480 cubic in. displacement, develop 345 hp. at 3,400 rpm. for takeoff; are rated 320 hp. at 3,200 rpm. for maximum continuous power.

By comparison, the earlier D50, with its Lycoming C2C6s, developed 295 hp. for takeoff; rated 285 hp. for maximum continuous power.

Twin Installation

Twin installation of the supercharged engines was first tested on a Model 50 four years ago. Lycoming has run the A1A6 for 92 hr. at full takeoff power with no damage indicated at tear-down, according to a Beech representative. Present overhaul time on the high-compression engine is 600 hr., but the company expects this figure to increase.

Power plant system and equipment are automatic in operation. Engines are equipped with Bendix PSH-7BD pressure carburetors, with automatic altitude-compensation mixture control. Altitude compensator maintains fuel-air ratio at optimum. In case of malfunction, manual mixture control levers may be used.

Engine cooling system is automatic, via exhaust augmentor tubes at back of nacelles. Engine oil temperature is controlled by thermostatic bypass valve in the oil radiator. Pressure gear primer button helps eliminate lead deposits in chamber by squirting raw fuel into engine.

Plugs are platinum pointed.

E50 wing loading at 7,000-lb. gross weight is 25.2 lb. sq. ft.; power loading at gross weight is 10.9 lb. hp. Load factor of 8Gs is designed to withstand in-flight loads of 28 tons.

Airplane used for our flight evaluation was N355B, Serial No. EH-10, a factory demonstrator. Flying with us was G. Allen Raines, Beech sales representative.

Dry weight of airplane with optional equipment was 4,781 lb. With 1,200 lb. of fuel (200 gal.), 64 lb. of oil (8 gal.) and combined passenger-baggage weight of 560 lb., the demonstrator E50 grossed about 6,565 lb. before takeoff.

Service ceiling of the Twin-Bonanza is specified at 24,800 ft., with 100 fpm. climb reserve. Single-engine service ceiling, with 50 fpm. climb reserve, is 11,-

Bob Stanfield

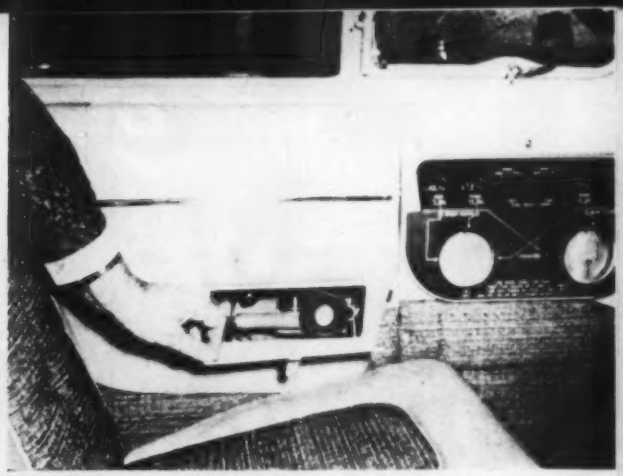
Aviation Week's Bob Stanfield learned to fly in the pre-war Civilian Pilot Training program of 1941. During World War II he flew C-46s, C-47s, C54s, C-87s and C-109s with the North Atlantic and India-China divisions of the Air Transport Command.

Following the war, Stanfield put in two years with Eastern Air Lines and Northeast Airlines, flying domestically out of the New York area on DC-3s, DC-4s and Constellations. Before joining NEA he served for six months with the Atlantic Division of MATS.

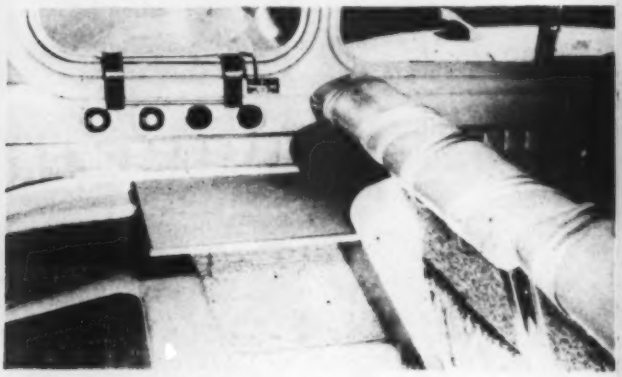
Most of his current flying is done with the Air Force Reserve as an instructor-pilot.

Stanfield has logged over 4,000 hours and has flown single and multi-engine personal and executive planes and transports. He holds a commercial license, single and multi-engine, with instrument rating and is rated a Senior Pilot in USAF.

FULLY AUTOMATIC retracting step provides easy access to cabin.



ARMREST houses headset, mike; fuel panel is at right.



FOLDING DESK hinges into rear of any front seat.

550 ft. At 6,000 lb. gross, this increases to 15,000 ft.

Taxi and flight characteristics of the airplane are good. Large transparent areas, including green-tinted side windows, make for good visibility. From either side of the cockpit one can look rearward and see the vertical stabilizer topped by rotating beacon. Rudder pedals control nose-wheel steering, limited to 15 deg.

Turns in excess, with deflection 45 deg. either side of center, require combination of brakes and throttle.

At takeoff, manifold pressure is mechanically set at 48 in., rpm. will hold to 3,400. Nose wheel is raised at about 75 mph.

Swift Acceleration

The airplane went off smoothly at 85 mph., immediately reached single-engine speed of 90 mph., swiftly accelerated to 125 mph. Rate of climb was 2,000 fpm., with forward visibility remaining excellent during the climb. Climb power was 42 in. manifold pressure, 3,200 rpm. At 8,500 ft. rate of climb was 1,700 fpm., IAS was 125 mph.; at 10,000 ft. 1,500 fpm., 120 IAS. Only minor trim adjustments were necessary during climb.

Rudder pedal movement in the E50 was advanced to give about $\frac{3}{8}$ in. more travel, making for less rudder pressure for same control.

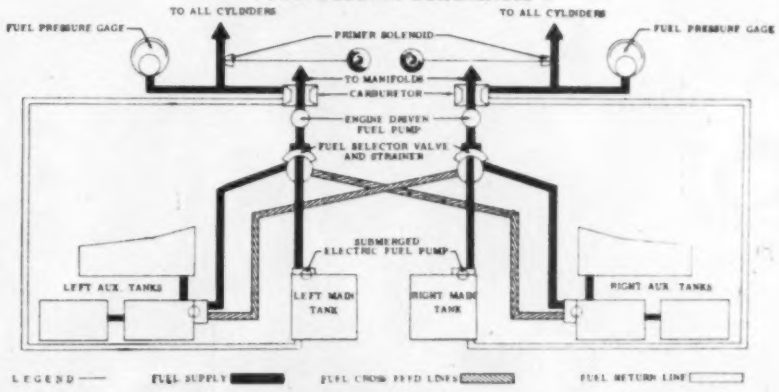
This was done to compensate for the increased power of the E50 over the D50.

At 13,000 ft. level flight, with temperature 6 deg. F. carrying 32 in. MP and 2,750 rpm., the E50 held IAS of 220 mph.

Airplane trimmed out neatly for hands-off flight. Improved lateral stability and control is provided by anti-servo action of aileron tabs. Right aileron tab is anti-servo only. Left tab has both anti-servo action when aileron is moved and servo action, operated by trim tab control for lateral trim.

Propellers are Hartzell three-blade, full-feathering and constant-speed. Feathering is accomplished by pulling back on prop control past the detent to limit of travel. At 13,000 ft. it took about 12 sec. for the right engine to fully feather. With 70% power on left engine—31.50 in. MP and 2,730 rpm. —airplane took one minute to decrease to 170 IAS; in two minutes fell to 158 IAS; held steady at 140 IAS. Slow decrease emphasized clean lines of the aircraft. It was easily held by control

FUEL SYSTEM SCHEMATIC



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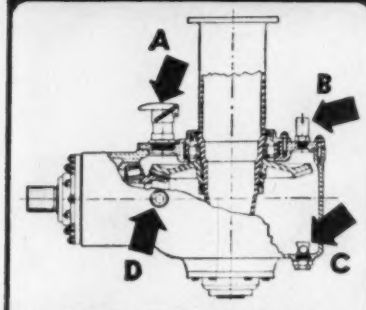

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E50 Twin-Bonanza

High Speed at 9,000 Ft.	240 MPH.
Cruising Speed (70% Rated Power at 13,300 ft.)	228 MPH.
Cruising Speed (65% Rated Power at 10,000 ft.)	212 MPH.
Service Ceiling (Two Engines)	24,800 FT.
Service Ceiling (Single Engine at 6,000 lb. Gross Weight)	15,500 FT.
Absolute Ceiling (Single Engine)	12,500 FT.
Stalling Speed (Gear and Flaps Down)	80 MPH.
Stalling Speed (Gear and Flaps Up)	90 MPH.
Gross Weight	7,000 LB.
Empty Weight	4,440 LB.
Maximum Range (42.2% Power at 10,000 ft., No Reserve)	1,650 MI.
Cruising Range (65% Power at 10,000 ft., No Reserve)	1,310 MI.
Fuel Capacity (Including 50 Gal. Optional Auxiliary Tanks)	230 GAL.
Oil Capacity (4 Gal. Each Tank)	8 GAL.
Rate of Climb at Sea Level (Two Engines)	1,620 FPM.
Rate of Climb at Sea Level (Single Engine)	245 FPM.
Takeoff Distance (20 Deg. Flaps) Over 50 ft. Obstable	1,250 FT.
Landing Distance (30 Deg. Flaps). Over 50 ft. Obstacle	1,840 FT.
Engine	Lycoming Horizontally-Opposed, Six-Cylinder Supercharged GSO480-A1A6 Developing 345 hp. at Takeoff
Basic Price, F. A. F. Wichita	$88,000

(Performances Are Guaranteed Within Plus or Minus 3%)

DIMENSIONS

CABIN		Forward Loading	200 LB.
Length	119 IN.	Aft Loading	300 LB.
Width	54 IN.	AIRPLANE	
Height	51 IN.	Wing Span	45 FT. 3⅜ IN.
Passenger Door Size	36x37 IN.	Length	31 FT. 6½ IN.
BAGGAGE COMPARTMENTS		Height	11 FT. 4 IN.
Forward Door Size	21½ x 19¾ IN.	WING	
Forward Compartment Size	14 CU FT.	Area	277.06 SQ FT.
Aft Door Size	26½ x 26¾ IN.	Loading at Gross Weight	25.2 LB./SQ. FT.
Aft Compartment Size	41 CU FT.	Power Loading at Gross Weight	10.9 LB./HP.

pressures until proper trim was effected for hands-off flying.

Stall Characteristics

E50 stall characteristics are exceptionally good. Warning light flashed about 5 mph. ahead of actual stall. Airplane buffeted well ahead of stall. At 11,000 ft., gear and flaps up, power off, a stall was accomplished at about 75 mph. With standard recovery, maximum altitude loss was 100 ft. Lateral stability was excellent.

Stability of E50 was further evidenced in single-engine stall at 11,000 ft., right engine out, 65% power applied, gear and flaps up. With aircraft trimmed and with feet off rudder pedals, using aileron control only, the airplane preceded the stall by series of buffets. Warning light gave ample advance notice. There was plenty of time for recovery, loss of altitude was negligible.

Due to inherent cleanness, the E50 will build up speed rapidly during descent.

Caution is required in use of throttles in a descent. Maximum diving speed is 270 mph. After reaching 2,500 ft. altitude, the airplane cruised at 190 mph. IAS using 60% power.

Short-Field Take-off

Short-field takeoff was initiated with 20 degrees flaps. Brakes were held while engines were revved. When brakes were released, aircraft accelerated quickly and was pulled off in about 500 ft. Single-engine speed of 90 mph. was attained simultaneously with pull-off.

During short-field landing, aircraft was dragged in, full flaps, coming over the fence at 80 mph. Slightly over 1,000 ft. of runway was used.

Fuel consumption, which will vary with BHP/engine and altitude, averages slightly over 30 gal. hr.

This is somewhat higher than that of the D50, but is to be expected with the new supercharged, high-compression engine.

Tank capacity of E50, including optional auxiliary wing tangs (25 gal. each) is 230 gal. Standard equipment includes two main tanks of 44 gal. each, two auxiliary tanks of 46 gal. each, for total of 180 gal.

Maximum Range

Optional auxiliary tanks give the E50 a maximum range of 1,650 mi. For example:

- **Cruising range** at 10,000 ft., with 65% of power and IAS of 212 mph. (no reserve), is specified at 1,040 mi. with 180 gal. fuel; 1,310 mi. with 230 gal.
- **Maximum range,** same altitude (no reserve) with 42.2% power and 169 mph. IAS is 1,280 mi. with 180 gal. (about 7½ hrs. flying); 1,650 mi. with 230 gal. (over 9½ hrs. flying).

Optional equipment consisted of air conditioner, nose taxi light, Grimes rotating beacon, soundproofing, auxiliary wing fuel tanks, 100 amp. generator, propeller anti-icer, couch and Model-18

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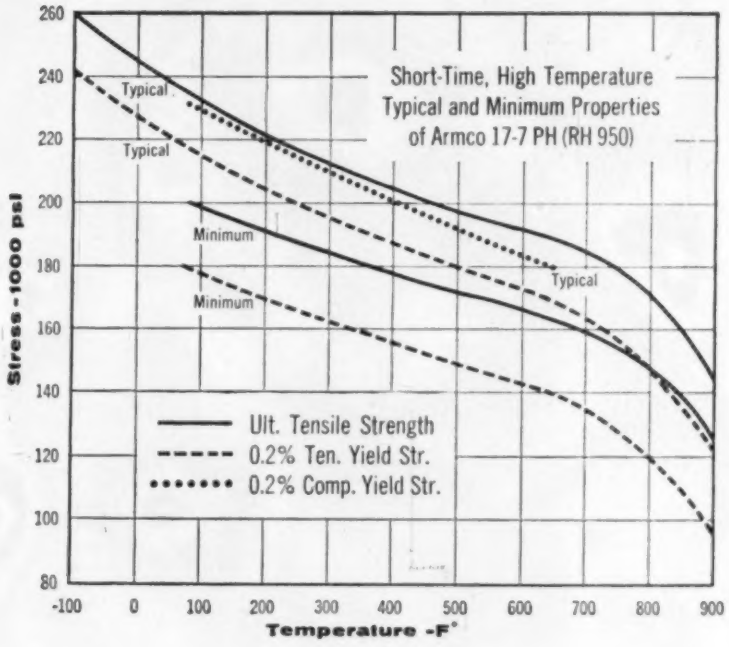

New RH 950 heat treatment for 17-7 PH creates outstanding strength-weight ratios at temperatures up to 900F.

Properties like these indicate why Armco 17-7 PH Stainless Steel is creating high interest among structural, power and accessory design groups from coast to coast.

Uniformity Assured

The new heat treatment for 17-7 PH makes it one of the strongest aircraft materials available. Minimum tensile properties at room temperature are guaranteed. You are assured of this basic uniformity in a wide range of gages and sizes in sheet, strip, and plate. Armco 17-7 PH is also available in the form of bars, wire and billets.

Fabrication, Heat Treatment Simple

Fabricated in the annealed condition, Armco 17-7 PH is readily formed, drawn and welded. After fabrication the properties shown above are developed by the simple RH 950 heat treatment. It consists of 10 minutes at 1750 F, air cool; —100 F for 8 hours; and 1 hour at 950 F.

Armco 17-7 PH Condition RH 950 is already being designed into missiles and aircraft. It helps assure performance according to design.

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type reclining chair (replacing standard rear seat), and card table.

Optional radio-navigation package "B" embraced Narco 1016 transceiver, ARC 15D Omni, ARC T20 VHF transmitter, Flite-Tronics CAA audio amplifier, Narco 1016 antenna, microphone and headset.

Individual optional radio equipment included ARC Type 21 ADF, Flite-Tronics MB-3 marker beacon receiver, ARC 15D Omni (providing dual Omni installation), and Wilcox 700B glide-slope receiver.

The demonstrator we flew, with its optional equipment, sells for $109,430. Beech anticipates sale of more than 150 Twin-Bonanzas this year, E50 predominating, at average of $102,000 FAF. Standard model, including night flying equipment, landing lights, cabin heater and fresh air ventilating system, and fully automatic high-pressure oxygen system, costs $88,000.

To provide easy cabin entrance, an stair-type step extends from the trailing edge of the right wing and retracts into fuselage beneath rear baggage compartment. Step is carried by a keyed tubular shaft supported in bearings so it may rotate in raising or lowering.

Fully automatic, this step also may be extended or retracted, when aircraft is parked, using a key-operated switch located on the right side of fuselage back of rear baggage compartment door.

In automatic operation, the step will retract whenever the right engine is started or right engine boost pump is turned on, as an up-circuit is energized by pressure switch in right engine fuel system when fuel pressure reaches 5½ psi. Step will automatically extend whenever right engine is stopped and boost pump turned off.

Should the right engine be lost in flight, extension circuit is routed through landing gear safety switch. Right main strut must be compressed by weight of airplane before step will extend.

Step Circuit-Breaker

Best precautionary measure, in event of right engine out in single-engine landing, would be to pull step circuit breaker. This would prevent step extension in event of touchdown followed by emergency go-around.

Design of cabin door incorporates a new latching mechanism, including positive visible inside lock and latches at top, back and bottom. Included is new-type rubber door seal.

Roomy cockpit is keyed to operation by one pilot. However, dual rudder pedals and throw-over type aileron-elevator control arm allow for interchangeable flying.

E50's edge-lighted fuel system controls, as with the D50, are panel-mounted on left fuselage sidewall. Two engine fuel selectors are recessed into the panel, which embraces schematic diagram of fuel system. Individual fuel quantity gages, with lights, are mounted across top of panel. Four booster pumps, actuated by three-position switches, are provided for each of the four fuel tanks.

Beech recommends main tanks for takeoff and landing. Fuel should be used from the mains for the first hour of flight to offset vapor returns from pressure carburetors, which return three gallons of fuel per hour per engine to main tanks.

Cross-feed system operates through fuel selector valves permitting use of fuel from either auxiliary tank to either engine. Earlier model D50 cross-fed to main tanks only.

At far left of instrument panel, positioned slightly in from wall for easy accessibility, are four toggle ignition switches, one for each magneto, plus two button starter switches.

New shock-mounted, hinged instrument panel mounts all instruments except fuel gages and gear-position indicator. Flight instruments are grouped according to SAE recommendations, in front of pilot. Engine instruments are centered above throttle quadrant and radio panel is mounted to right of quadrant in front of copilot.

Flap and gear switches, with safety locking levers, are positioned on opposite sides of quadrant. Instruments and controls are easily read and accessible from either left or right seat.

Trim-control wheels are mounted under throttle quadrant. Circuit breakers are located in left and right subpanels below the instrument panel except for generators and landing gear motor, which are mounted in the floor just ahead of pilot's seat.

Edge Lighting

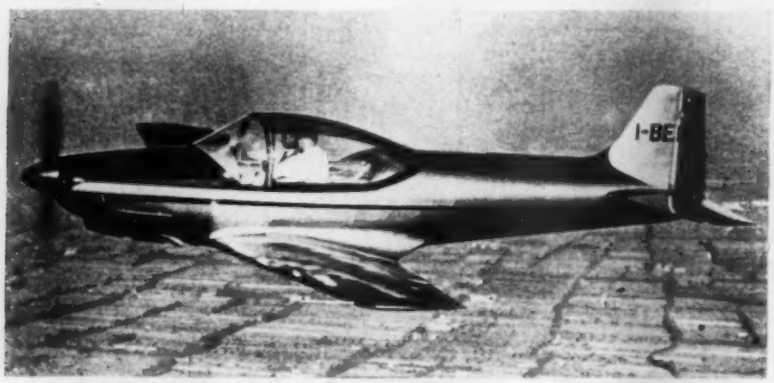
Individual instruments feature small, hooded bolt lights. Along with fuel panel, the radio control panel and overhead light-control panel are edge-lighted.

Individual rheostats also control light intensity of engine and flight instruments, map lights and cabin red lights.

Twin radio loudspeakers are mounted in cabin dome. Pilot's lightweight Telex headset, ear-plug type, can be used as desired; it is designed to reduce the level of outside engine noise. Headset is stowed in special compartment directly below pilot's left arm-rest, along with microphone and headset jacks.

New, flexible glare shield surmounts instrument panel. Shock-absorbent shield extends about six inches from top of panel, is about one inch thick.

Zep automatic, constant-flow oxygen system is standard equipment. Pressure regulator, on rear bulkhead, regulates flow. Larger orifices for pilot and co-



Italians Produce Personal Plane

Two-place Aviamilano Falco F.8 private plane is designed for a top speed of 211 mph. on a 135-hp. Lycoming 0290-D engine. Normal cruise speed at sea level is stated by the manufacturer to be 186 mph. The Falco F.8 takes off in approximately 500 ft.; lands in about 450 ft. It has retractable tricycle landing gear. Gross weight is 1,540 lb. and empty weight is 1,012 lb. Service ceiling is given as 18,590 ft. and range with a half-hour reserve is 745 mi. Aviamilano provides these dimensions: Span, 26.24 ft.; length, 21.22 ft. The F.8 is in production by Aviamilano Costruzioni Aeronautiche, Milan, Italy.

pilot give them twice as much oxygen as passengers. Lightweight Zep disposable-type masks are used.

Emergency exits are provided through windows adjacent to passenger seats on both sides of aircraft. Quick-release mechanism precipitates fall-out of each window.

Fully automatic heating and ventilation system, thermostatically controlled, provides heated and cold fresh air, both inflight and on ground. System also has manual control for individual preference.

Air vents are set on bevel, at angle, for flexibility.

Cold-Weather Starts

Optional engine pre-heat system, for cold-weather starts, consists of flexible ducts connected to heater discharge plenum which can be plugged into openings in engine nacelles.

Six different seating arrangements allow from four to seven-place capacity. Demonstrator carried three-place front seat with three-place 6 ft. 10 in. lounge-couch and reclining chair in rear.

Other arrangements include two reclining chairs rear (positioned by widgets), plus pilot's and copilot's seat front, or one three-passenger rear seat. Two-place front seat includes sliding copilot's seat, mounted on tracks, which gives easy entrance to rear seats. With three-seat front, seat adjacent to cabin door hinges forward for accessibility to the rear.

Two separate baggage compartments, one aft of cabin door and one in nose, provide 55 cu. ft. of storage space. Forward compartment has 200 lb. maximum allowable load; that in the rear may be loaded to maximum of 300 lb. Electric guard-switch prevents engine starts when nose baggage door is open.

More than 4,000 color combinations are available for exterior design. Interior includes wall-to-wall carpeting, plus combination of silicone treated fabrics and imported Danish leather.

Optional soundproofing entails asphalt base material sprayed on inside skin surfaces. This is topped with Fiberglas material, a panel of aluminum sheeting, more Fiberglas, then upholstery. Installation runs from nose to rear bulkhead.

Nylon webbing seat belts, manufactured by Davis Aircraft Products, Inc., are colored to match interiors. Belts feature new, quick-release buckle.

Lycoming Engine Gets Three-Way Study

An intensive three-pronged study by Lycoming, Aero Design and the Civil Aeronautics Administration is in progress to determine the cause of holes being burned through the pistons on supercharged GSO480-A type powerplants.

Approximately nine cases of this incident have been reported to CAA, a member of that agency told AVIATION WEEK last week. He emphasized, that although the problem has resulted in single-engine forced landings, there has not been a single accident traceable to this cause.

Lycoming has leased an Aero Commander 680 supercharged business plane and is running an intensive flight test program to determine under what condition the problem occurs. The engine manufacturer has been unable to duplicate the failure on a test stand.

The problem appears to occur during the cruise condition, the CAA spokesman indicated. He noted that the more sophisticated supercharged engine requires closer adherence to the manual for optimum operation than do previous less advanced models.

Aero Design & Engineering Corp. is also flight testing a Super 680 to determine the possible cause of the piston burnout.

Cessna Sees Decline

Cessna Aircraft Co. believes that its business aircraft volume may decline somewhat in 1957. According to the company's recently issued annual report, Cessna says that it does not expect that the demand for the Models 172 and 182 will hold the record levels of 1956.

It also notes that sales of the light twin Model 310 "will probably dip" from the 1956 volume. Reason: The pent up demand for light twin aircraft has been largely surfeited by the high volume for the past couple of years, Cessna states.

PRIVATE LINES

Fison-Airwork, Ltd., England, ordered its third Westland Whirlwind (S-55) helicopter and placed an option for a fourth. The firm will use the new helicopter to supplement two it has chartered to Shell Petroleum Exploration Co. in Nigeria.

Royal Gull amphibian is latest business plane to have Safe Flight stall warning equipment installed as standard factory-installed gear. This brings to seven the number of business plane manufacturers making the equipment standard.

Executive pilot training facilities of Flight Safety, Inc., LaGuardia Field, N. Y., are expanded with opening of a branch operation at Houston Municipal Airport's old terminal building. New installation is equipped with Link trainers modified to incorporate automatic aids, modern instrumentation and control forces to simulate aircraft.

Van Dusen Aircraft Supplies acquired Eastern Airmotive Corp., Richmond, Va. and will operate the firm as its Southern Division. Van Dusen continues to operate its Alexandria, Va., facility to serve the Washington, D. C., area.

Three aviation scholarships have been established at Stephens College Aviation Department, Columbia, Mo. Arlene Davis Flight Scholarship will be awarded to a student at the end of her first year, generally to an applicant who has not taken flight training because of the cost; Dwane Wallace Aviation Scholarship, given by Cessna, goes to an outstanding first year student for flight study and the third scholarship has been presented by Mrs. Olive Ann Beech, president of Beech Aircraft Corp., to stimulate interest in aviation study.

Informal indoctrination to Piper Tri-Pacer is presented in pocket-size 32-page promotion booklet written and illustrated by Bill Mauldin, creator of "Willie and Joe" World War II cartoon characters. Attached to the rear cover is a stamped, addressed card to Piper sales department requesting free demonstration.

Customer prospects are invited by Ipsen Industries, Inc., to visit its Rockford, Ill., heat equipment treating laboratory using the company's Aero Commander business plane at no charge. Guests are invited to bring along "problem parts" for a detailed analysis and procedures recommendation by the laboratory.

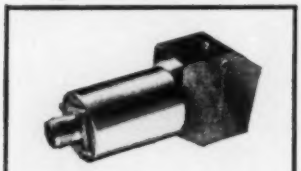
American Airmotive will spend $2 million on a maintenance shop expansion program at Miami (Fla.) International Airport designed to service turboprop and turbojet powerplants. The firm is currently providing some $3,000 weekly of line maintenance for Vickers Viscounts of Cubana Airlines and British West Indies Airways. When the new building is completed, in about nine months, the maintenance firm expects to increase employment by 500, bringing total to 1,200.

Flight guide to Latin America and the Caribbean Islands provides data on required documentation, flight procedures, flight information, needed equipment, check list and various other valuable tips. Write Flight Service, Aircraft Owners & Pilots Assn., Washington 14, D. C.

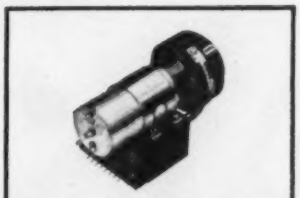
Giannini Instruments and Controls for almost every airborne application

Whether single components or complex packaged systems, virtually all operational military aircraft (and civilian, too) use reliable Giannini precision-crafted instruments and controls.

When performance demands precision, specify Giannini products—they're available for *almost* every airborne application.



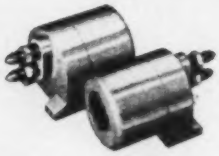
Hydraulic Valves



Rotary Sampling Switches

Temperature Probes

Differential Pressure Flight Angle Computers

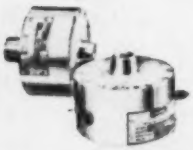


Low Pressure Transducers

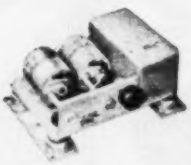
Gyro Instruments

Accelerometers

Aerodynamic Angle of Attack Transducers



High Pressure Transducers



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Gains Reported in Avionic Reliability

By Philip J. Klass

Washington—Avionics equipment systems with "much improved reliability" is now entering military service as a result of major gains made over the past year.

This encouraging report was made by James M. Bridges, keynote speaker at last week's third National Symposium on Reliability and Quality Control in Electronics. Bridges is director of electronics in the Office of the Assistant Secretary of Defense for Engineering.

Examples cited by Bridges as evidence that industry-military reliability programs are finally beginning to pay off included:

- **Fire control system**—believed to be the one developed by Hughes Aircraft Co. for the F-102—has had mean time between failure increased from three to 18 hours during the past year. Despite the fact that the system has 43,000 parts—more than twice as many as older Hughes systems—its mean time between failure is three times greater.
- **Airborne digital** bombing-navigation computer developed by Librascope with 10,000 parts—including 300 tubes, 96 transistors and 5,000 diodes—has operated for 450 hours, 135 of them in the air in tactical exercises, with only four failures. Only one of these failures affected flight availability, according to Bridges.
- **One magnetron manufacturer** has increased mean life between failures from 45 hours to more than 500 hours through improved design and manufacturing processes.
- **Transistorized multiplex telegraph set** containing 570 transistors and 739 diodes has operated over 5,000 hours with only two transistor failures.

Little Progress in One Area

The one area where comparable progress has not been made, according to Bridges, is "in improving the policies and practices of procurement." He added:

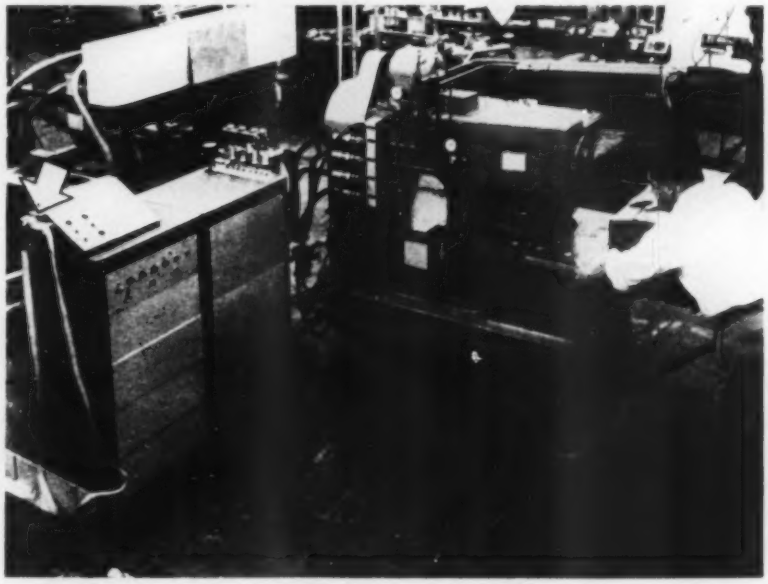
"Emphasis on competitive cost in the procurement of both development and production is still a major deterrent to obtaining real reliability in military electronic equipment.

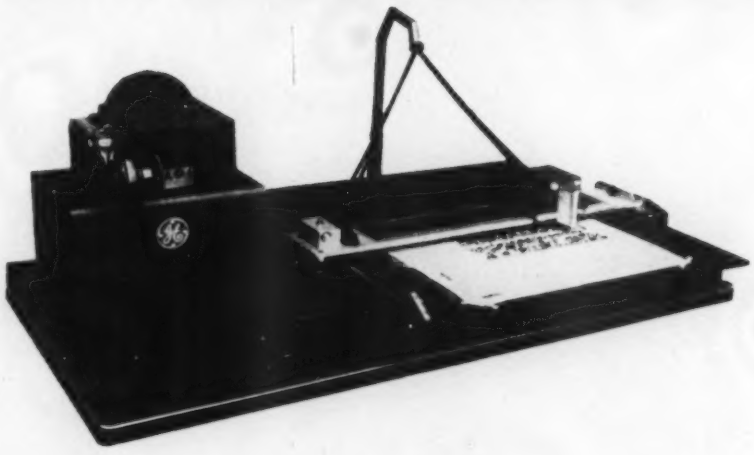
"It is improbable that a highly reliable equipment will ever be produced if the price has been forced so low that short cuts in engineering or manufacturing are required.

"Neither have we made much progress in convincing procurement people that substantial reliability improvements result from keeping the same contractor on the job through development and initial production."

Bridges, however, said he hopes that these and other remaining barriers to reliability improvement will be overcome in 1957 "by direct action or further education."

One of the important reliability lessons learned from the military Tacan





Automatic Punch Press

Automatic punch press, developed by General Electric, operates from punched tape (arrow). Machine can punch 50 holes per minute in printed circuit boards with hole location accuracy of 0.001 in. Punched tape program is prepared from enlarged drawing of printed board showing hole location. Operator selects punch size, then positions pantograph over drawing and pushes it into hole centerline which records its location on punched tape. Tape control and programmer were developed by GE's Light Military Electronics Equipment Dept.

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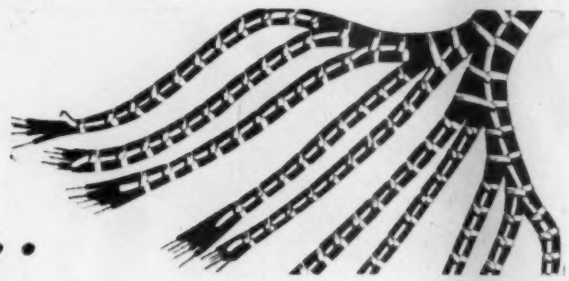

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program is that controlled laboratory service tests under simulated operating conditions provide far more useful data faster than that provided by actual field tests.

For example, early field tests on Tacan sets achieved a total of only 5,000 set operating hours over a 12-month period, pinpointing nine design problems. Subsequent controlled laboratory tests on 150 sets accumulated a total of 50,000 set operating hours in only four months. These revealed the need for 22 design changes as compared with the nine disclosed by the previous year of field tests.

This program Bridges said, "taught a major lesson regarding the value of simulated operating tests, where variables can be carefully controlled, in determining design and component weaknesses in a short period of time." Bridges believes such tests are savers of time, money and manpower.

The Tacan tests also provided valuable reliability statistical data that has enabled the Navy to write specific reliability requirements into its new Tacan procurement contracts.

This is one of the first instances, Bridges said, of the military writing a quantitative reliability requirement into its procurement contracts and "represents a great step forward in the campaign for better reliability."

Data Feedback

Bridges said the remarkable improvement in the reliability of the F-102 fire control system stemmed from a Hughes program which permitted rapid feedback of data on failures occurring during production line tests to its engineering department for speedy analysis and correction.

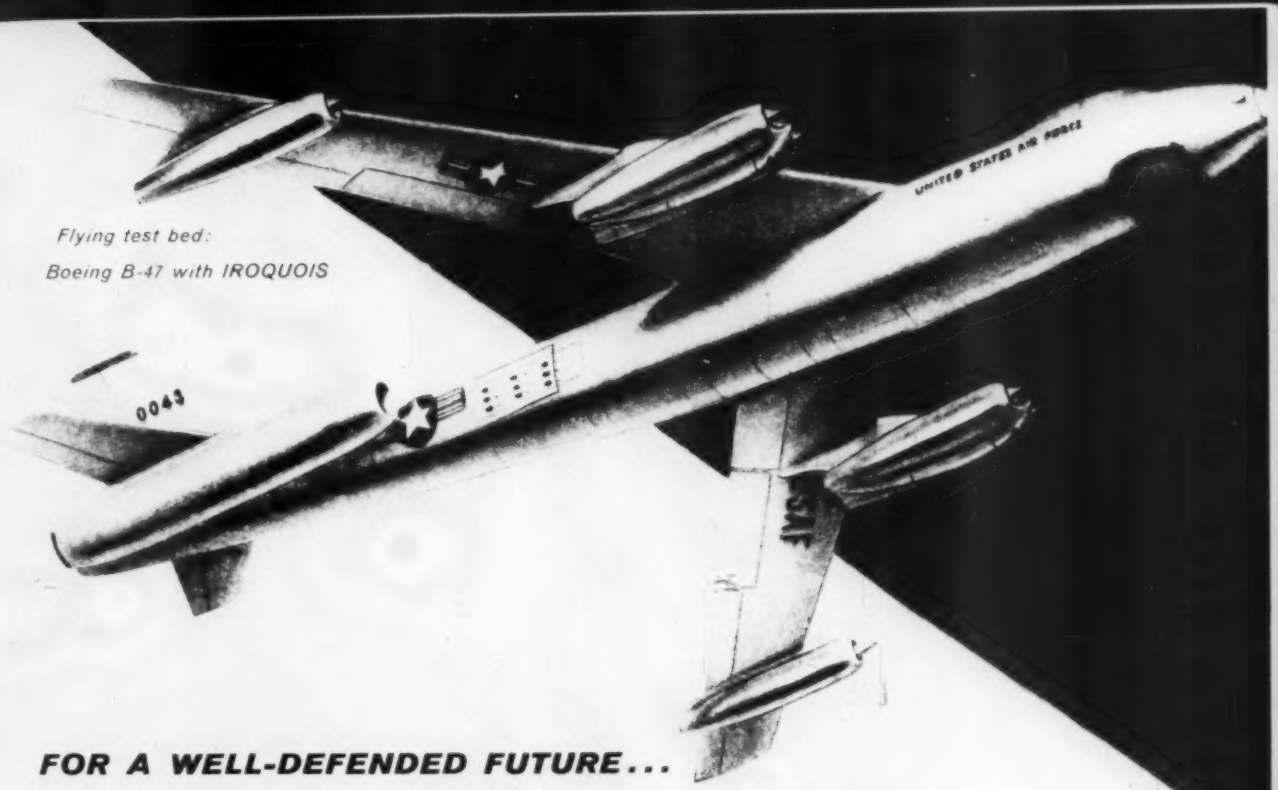
He pointed out that this kind of in-production reliability improvement program is possible only when the design and initial production are done by the same contractor.

Such an arrangement is "essential," Bridges said, to meet the intent of the Department of Defense Directive No. 3222.1 (issued July 5, 1956) which requires reliability testing of new equipments and pilot production prior to full-scale production.

Bridges said the Army has formally implemented this directive, and that the Air Force and Navy are in the process of doing so.

The new Defense Department program to set up a uniform field failure reporting system for all military services so that such information can be speedily processed and analyzed by automatic computers is expected to provide valuable data for correlating actual field reliability with that obtained in controlled reliability tests in the laboratory.

The program also should make it



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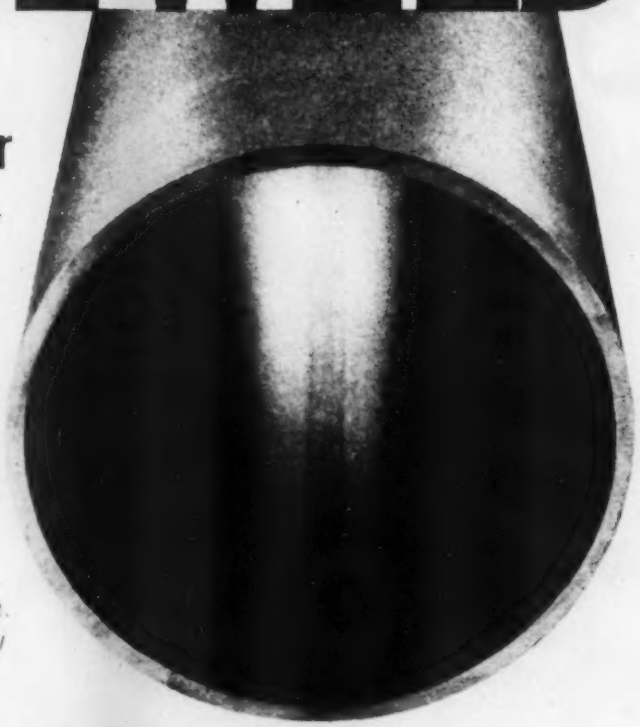

New Contour-Trentweld outperforms any other pipe, welded or not. Here's why: *Contour-Welding* is an entirely unique method of producing pipe and tubing. It puts gravity to work to pull down the molten weld metal until it exactly conforms to the contour of the pipe. Result: A smooth pipe or tube free of undercut or bead.

What's more, the *Contour-Weld* process *starts* with uniformly rolled stainless strip, which insures constant wall thickness throughout the pipe.

But the only way you can fully appreciate the advantages of new *Contour-Trentweld* is to try it. We think you'll agree, *it can't be beat by any other pipe, welded or not.*

Why Trent's Exclusive Contour-Welding Process Means Smoother Welds . . .

Normally, in producing welded pipe, the weld is made at the top. But gravity plays a nasty trick. It tugs at the fluid metal in the weld zone, pulling it down toward the middle of the pipe. The result, particularly in the heavier gages, is a perceptible bulge where it hurts the most – right on the I.D. surface. If you try to get rid of the bulge – at fair cost – the metal is undercut – and corrosion and erosion start there.

But Trent put a stop to that – simply by going into partnership with gravity. With their exclusive *Contour-Welding* process, they weld at the bottom – and gravity works for them. For them, the bulge is in the opposite direction – blending in perfectly with the contour of the pipe itself.

CONTOUR TRENTWELD

Stainless and High Alloy Welded Tubing

TRENT TUBE COMPANY, GENERAL SALES OFFICES, EAST TROY, WISCONSIN (Subsidiary of Crucible Steel Company of America)

possible to establish an index of reliability for specific tubes and components that will enable equipment manufacturers to predict overall reliability during design as well as enabling component makers to improve their products.

Standardized Modular Design

Bridges noted that the Navy Bureau of Aeronautics has issued a preliminary specification for industry comment proposing standardization of dimensions for plug-in modules to be used in all of its avionics equipment. The Air Force has a similar program, including definitive reliability specifications, for new airborne communications equipment.

Bridges hopes these programs will result in a single joint services standard for avionics equipment. Such action he said, "would have a very beneficial effect upon reliability because of the potential increase in production quantities of similar modules."

The nine task groups that the Defense Department's Advisory Group on Reliability in Electronic Equipment (AGREE) set up more than a year ago for an all-out military-industry attack upon the reliability problem are expected to submit their individual reports soon. These include specific recommendations for quantitative reliability specifications, procedures, tests and procurement practices needed to improve reliability.

Individual Task Group

The individual task group reports will be combined into a single report which should become available to industry before fall. Bridges said the report will represent the most complete and valuable analysis of the many phases of the reliability problem ever compiled and should be a major contribution to further gains in reliability.

Despite excellent progress to date, Bridges says the reliability battle is far from won. The reason: weapon systems are becoming continually more complex and the demand for more and more reliability increases accordingly. He adds:

"The cost of aircraft and missile systems is constantly increasing, as well as their lethality. The penalty for weapon failure is therefore becoming progressively more serious and unacceptable."

Electra Wing Jigs

These massive, 40-ft. long, 15-ton jigs are for Lockheed's Electra turboprop transport. There are four jigs, one each for the upper and lower surfaces of the right and left wing. Assembly of trailing edges and of wing front beams is scheduled to start immediately. The jigs, which were completed ahead of schedule, maintain an accuracy of .005 in. First flight of the 450 mph. transport is planned for January 1958.

Airborne Radar to Aid Air Traffic

An airborne radar beacon which will enable commercial and business aircraft to notify air traffic control centers automatically of their presence and identity has been developed by Radio Corporation of America.

The compact 25-pound device, known as an Air Traffic Control Transponder Beacon (AVQ-60), is hardly bigger than a tool kit, yet has a receiving and transmitting range in excess of 200 mi.

David H. Robinson, said the transponder "assures more effective utilization of the airspace by commercial airliners and business aircraft, particularly in busy terminal areas, since it identifies the aircraft as soon as it comes within range of the air traffic control center's interrogation transmitter."

The device is triggered automatically by ground-based interrogator transmitters, the AVQ-60 transponder system instantly initiates a responsive broadcast of its identification—in coded form—which is received on a radarscope in the ground center.

This information enables the traffic controller to identify and locate the approaching aircraft, notify other airplanes in the vicinity of its presence, and assign it to a particular airspace so that it can be scheduled into the area traffic situation.

Normally, aircraft must radio their location and identification to the controllers and then await radio confirmation from the center or towers that they have been identified positively in the traffic complex.

Transponder-equipped aircraft, by speeding the identity procedure and location fixes, contribute to more rapid and precise traffic flow.

The RCA ATC transponder measures only 4¾ inches wide, 7¾ inches high, and 19⅞ inches long; is housed in a standard ½ ATR form factor; and is designed in compliance with Arinc characteristic 532-A.

Robinson said the AVQ-60's compact dimensions result from a new design approach to transponder equipment.

Some major engineering advances include:

• **The first use** of a beam switching tube for coding operations. The application of an electron tube instead of conven-

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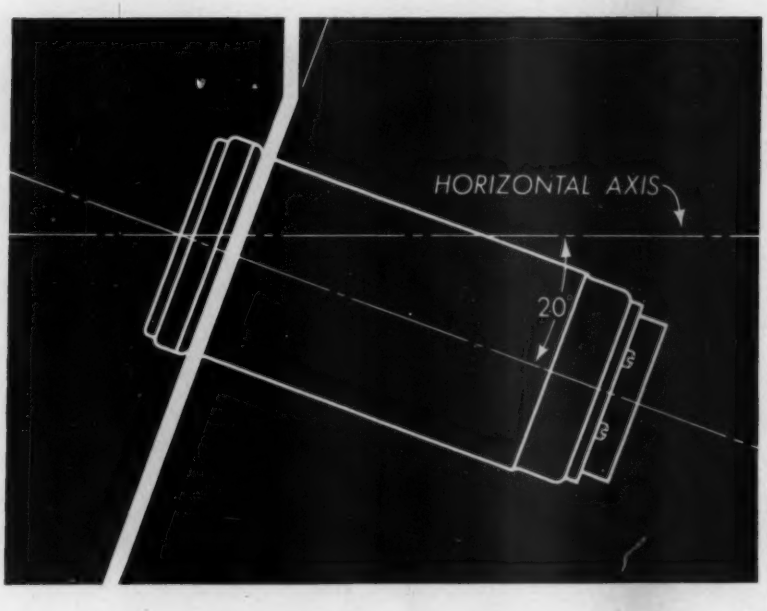


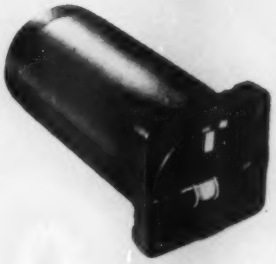
NEW BENDIX TURN AND SLIP INDICATOR FOR TILTED PANELS

If there's one thing constant about the aircraft industry, it's the fact that its problems are always changing.

For instance, the introduction of slanting instrument panels on some of the new military aircraft called for instruments that would indicate correctly under "tilted" conditions.

The answer for turn and slip indicators is the new Bendix Type 1730 with its gimbal axis tilted 20° to compensate for the new style mounting, without any increase in case diameter.

For information on turn and slip indicators, accelerometers, air speed indicators, machmeters, rate-of-climb indicators, oxygen breathing equipment, fuel flowmeter systems, and ultrasonic cleaning systems, write: PIONEER-CENTRAL DIVISION, BENDIX AVIATION CORPORATION, DAVENPORT, IOWA.



New, air-driven Type 1730 Bendix Turn and Slip Indicator with 2" dial meets performance requirements of Military Type MD-2. Two- and three-inch electric indicators are also available.

West Coast Office: 117 E. Providencia, Burbank, Calif.
Export Sales & Service: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.
Canadian Affiliate: Aviation Electric Ltd., 200 Laurentien Blvd., Montreal, Quebec

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Bendix AVIATION CORPORATION

tional tapped delay lines eliminates approximately 300 normally required components, with marked reductions in equipment size and weight. The tube permits greater flexibility in the arrangement and availability of distinctive sets of identification code groups. The pilot has access to 64 different code groups selectable at the flip of a switch.

• **Sub-assembly construction.** The RCA transponder features five sub-assembly units which can be disassembled quickly for inspection, maintenance or replacement.

Included are an RF section, IF and video amplifier, decoder, coder and modulator power supply.

• **Utilization of printed** wiring and semi-conductor diodes: printed wiring is employed in the decoder, coder and modulator-power supply sub-assemblies for maximum production precision and operating reliability. Silicon diodes are used exclusively in the power supply to assure longer, trouble-free operational life.

London Firm Develops Dielectric Test Sets

London—An instrument known as a dielectric test set for determining the electrical qualities and behavior of plastics, high temperature resins and other materials under the conditions of extremely high frequencies used in radar systems, has been developed by Microcell Ltd., 56 Kingsway, London, W.C. 2, England.

Another application of the equipment is the testing of materials used in the manufacture of aircraft radomes and in this connection, the company claims, the set is able to measure electrical characteristics at temperatures comparable with those generated in flight on the surfaces of supersonic aircraft which can rise to more than 105 degrees C.

The equipment has been designed for use by chemists who have little knowledge of electronics. Controls have been kept to a minimum and critical adjustments eliminated.

Edo Designs New Airborne Loran

A new airborne loran receiver designed specifically for installation in aircraft has been announced by the Edo Corp., College Point, N. Y. designer and manufacturer of precision electronic and navigational equipment. The new, light-weight unit, designated Edo Airborne Loran, Model 345, features a cockpit installation and display under pilot control, and has an installed weight of approximately 26 pounds.

Model 345 is a direct reading loran

Fire control radar tells... / WHERE TO AIM WHEN TO FIRE!

All-seeing radar pinpoints the target for these Air Force planes. Whatever armament they carry—guns, rockets or missiles—fire control radar tells them *where* and *when*. It provides the far-sighted vision necessary for modern long-range combat operations.

Today's modern fighter plane is an electronic wonder, with fire control radar-computer systems supplying a continuous flow of information about target position in terms of range and rate of closing.

RCA is a major supplier of airborne fire control equipment to the Armed Forces. It has produced, and in several instances developed, these systems for many of the latest aircraft. Some of these are illustrated above.

Defense Electronic Products

RADIO CORPORATION of AMERICA

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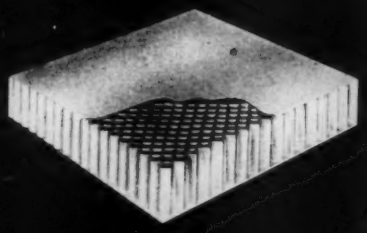
NEW STRUCTURAL CONCEPTS FOR MODERN FLIGHT



high temperature brazed stainless steel honeycomb

SANDWICH PANEL STRUCTURE

developed by Rohr, ranges in thickness from one-eighth of an inch to five inches and is used for straight, tapered, curved and compound contoured panels for wings, control surfaces and various similar applications. Strength values: edge compression 166,500 psi; simple beam, 10-inch span, 166,500 psi; short beam, two-inch span, 600 psi; F tu face 170,000 psi.

HIGH STRENGTH WELDMENTS

produced by Rohr meet high strength weight ratio requirements for modern airplanes. Rohr has developed special techniques for hot forming of detail parts and for heat treatment. Design of the weldments is an important factor in successful production, which is why Rohr supplies all production design of the units.

METAL BONDED STRUCTURE

comprises face skins, stiffening members and honeycomb core, and is being produced by Rohr for wing, power plant and empennage fairings, skin sections, trim tabs, deicer provisions and many other similar applications to take the place of rivets and bolts. Many such structures involve the joining of dissimilar metals to achieve weight reduction, giving wider latitude in aircraft design.

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receiver featuring remote control, automatic frequency control, and a fail safe characteristic. The flexibility achieved by the remote control of all switches permits the indicator and control unit to be mounted in limited space areas, such as the instrument panel of an aircraft.

The receiver, with four crystal-controlled channels at frequencies of 1750 kc, 1850 kc, 1900 kc and 1950 kc, has a wide-band superheterodyne circuit capable of handling reception under adverse conditions. Signal drift, due to irregularities of pulse repetition has been eliminated by automatic control of the receiver reference oscillator. Power requirements of the Model 345 are: power supply, 115 v, 400 cycles, single phase (approximately 175 watts); 24 volt d.c. (2.5 watts). Electronic power regulation provides for a line variation of 105 to 130 volts with no change in regulated output.

The installed weight of 26 lb., as contrasted to the 39 pounds of the APN-9 now in use in airborne installations, makes the new unit attractive to airlines and the military services which place a high premium on space and weight on the flight deck.

Circuitry and operation of the new Edo unit is a development of the marine loran which the company has been producing for some time.

Edo has been associated with the aircraft industry since 1925, as the leading manufacturer of seaplane floats. During World War II the company entered the electronics field for both aviation and marine equipment. The company also is active in hydrodynamic research.

Earnings of Bendix, Others, Increase

Bendix Aviation Corp. reported net sales, royalites and other operating income at $581,415,734 for the year ending Sept. 30 as compared with $567,249,923 for the previous year.

Earnings were $24,278,263 (or $5.04 per share) as compared with $25,888,599 (or $5.39 a share) for 1955.

Bendix President Malcolm P. Ferguson said a $20 million increase in payroll, a number of new-products programs and "substantial rearrangement associated with moving into numerous new engineering expansions" affected the year's operations.

Backlog stood at $544 million at the year's end, compared to $480 million for the previous year.

For the first time, Bendix was allowed to report that its Kansas City Division has for eight years held a prime contract with the Atomic Energy Commission for manufacture and assembly

Why Do Ambitious Engineers Like General Mills?

Let's be realistic. The answer is real technical competence in the company you work for, and real opportunity for yourself!

Our people start with good salaries, share in liberal company benefits. It's not necessary that they move from company to company to improve their salaries or to find more challenging opportunities. We recognize ability, make promotions and salary adjustments accordingly. And with new projects being started almost weekly, promotions come rapidly.

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FINANCIAL SECURITY . . . they know they work for one of the nation's largest and most diversified companies, paying dividends without reduction since 1929.

TUITION REIMBURSEMENT . . . many of them take advanced degrees at the University of Minnesota, under our tuition reimbursement plan.

FRIENDLY ATMOSPHERE . . . they work with congenial people who share the same interests as they.

LOWER COST OF LIVING . . . their dollars buy more, they can save more enjoy things not possible before.

DELIGHTFUL RESIDENCES . . . many of them live in "dream" homes in resort-like settings, only minutes from work.

TIME FOR FUN . . . they relax and enjoy themselves, because here there is time and opportunity for all kinds of activity in the land of 10,000 lakes.

We'd like you to investigate **YOUR FUTURE** with General Mills. Talk it over with your wife. We think she'll like it here too. Minneapolis is a wonderful town in which to raise a family—while you do big things in the field you like best.

Join in the excitement at General Mills, where important things can happen to you, in any of these fields:

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GEOPHYSICS
UNDERWATER ORDNANCE
ELECTRONIC COUNTERMEASURES
DIGITAL & ANALOG COMPUTORS
INSTRUMENTS & CONTROLS
SOLID STATE PHYSICS
MICROWAVES & ANTENNAS
INFRARED SYSTEMS
INERTIAL SYSTEMS
SYSTEMS ANALYSIS & DESIGN
SERVOMECHANISMS
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West Coast Sales & Service: 117 E. Providencia Ave., Burbank, Calif.
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Canadian Distributor: Aviation Electric Ltd., P.O. Box 6102, Montreal, Quebec

INVERTERS — 400-CYCLE OUTPUT

Type	Input		Rated Output			Max Altitude at Rated Output	Approx Wt. Lbs.	Designed to Gov't. Part No.
	Volts	Amps.	Volts	Phase	VA Rating			
12128	27.5	1	26	1	6	35,000	2.2	AN3496
12126	27.5	2	26	3	10	35,000	2.3	E1615
32B21	27.5	3	115	1	20	50,000	5	—
MG-93	27.5	12	115/200	1 3	100 100	65,000	10	E5134
MG-54	27.5	22	115/200	1 3	250 250	50,000	17	E5109
12142	27.5	22	115	1 3	250 250	35,000	13	E1617
12143-1	27.5	22	115	3	250	35,000	13	—
12143-2	27.5	22	115	1	250	35,000	13	—
*32B15	27.5	22	115	3	300	50,000	14	—
32E01	27.5	35	115	3	500	50,000	26	AN-3533-1
32E00	27.5	51	115	1 3	500 750	50,000	34	AN-3534-1
MG-65	27.5	52	115/200	1 3	750 750	50,000	35	E52805-2
MG-61	27.5	126	115	1	1750	50,000	54	53C6767
1518	27.5	126	115	1 3	1500 1800	20,000	37	—
32E06	27.5	160	115/200	1 3	2000 2250	50,000	56	E1725
32E03-3	27.5	150	115	1	2500	50,000	58	53B6227
*32E03-8	27.5	160	115	1	2500	50,000	65	53B6227
*MG-77	27.5	150	115/200	3	2500	50,000	65	—
*32B49	27.5	160	115/200	1 3	2500 2500	50,000	65	E54807
MG-81	27.5	160	115/200	1 3	2500 3000	50,000	61	E1725
MG-95	27.5	160	115/200	1 3	2500 3000	50,000	58	E54807
32E09	27.5	160	115	1 3	2500 3000	50,000	60	—
32B27	27.5	285	115/200	1 3	3500 4000	50,000	76	—

*These inverters have magnetic amplifier "static" type voltage and frequency regulators.
NOTE: D.C. Input Voltage shown is nominal value of 27.5 volts, but all units are designed for 26 to 29 volt operation. Input amperes shown are rated at 27.5 volts input.

Red Bank DIVISION

Bendix AVIATION CORPORATION

f "a wide variety of complex electronic, lectro-mechanical and mechanical de-ices" as a part of AEC's weapons rogram.

The one million sq. ft. plant employs ,300 persons and represents a $50 mil-on government investment.

Most of the company's gain in un-illed orders was in aviation, and Fer-guson reported an "encouraging trend" oward expansion of commercial avia-ion sales. He said electronics work onstitutes at least 40% of the corpora-ion's output.

Production for the armed services nd government was 69% of the corpo-ation's total, the same as in 1955.

Lear Inc.

New orders for Lear, Inc., totaled $80,938,000 in 1956, the largest vol-ume in the company's history.

Shipments exceeded those of any other year, but the backlog still attained record high of $64,745,000—a 21% increase over the 1955 backlog of $53,-450,922.

A. G. Handschumacher, Lear senior vice president, attributed much of the gain to expanded sales of automatic flight control and flight reference sys-tems.

Reaction Motors Inc.

Preliminary figures for 1956 show that Reaction Motors Inc.'s sales vol-ume increased by 100% during the year to more than $15.5 million.

The backlog increased 250% to $22 million.

Employment more than doubled, from 669 to 1,350 employes. Net profit was $333,000.

RMI also reactivated its Rockaway, N. J. plant during the year and leased an additional plant of some 25,000 sq. ft. nearby.

The company has "preliminary plans for further expansion of plant and equipment" and will soon begin opera-tion of its new test stand in the test area. President Raymond W. Young said new business prospects indicate that RMI will continue its growth in 1957.

Beech Aircraft

Beech Aircraft Corp., with a backlog of more than $100 million and $20 million in first quarter sales, declared a 30-cent cash dividend and a one-tenth for one share stock dividend.

The company will issue 74,928 shares of dividend stock for the 749,-280 common shares outstanding, and the dividend shares will be eligible for the cash dividend. Payment will be Feb. 28 to stockholders of record Feb. 7, and market value cash equivalent will be paid for fractional shares.

Price of Beech stock on the New York Exchange had risen almost $5 a share since the first of the year, appar-ently in anticipation of the optimistic first quarter report and dividend action. Beech first quarter sales were 17.5% more than last year's, and Mrs. O. A. Beech, president, added:

"... Our company expects this year's sales to exceed last year's record-break-ing sales."

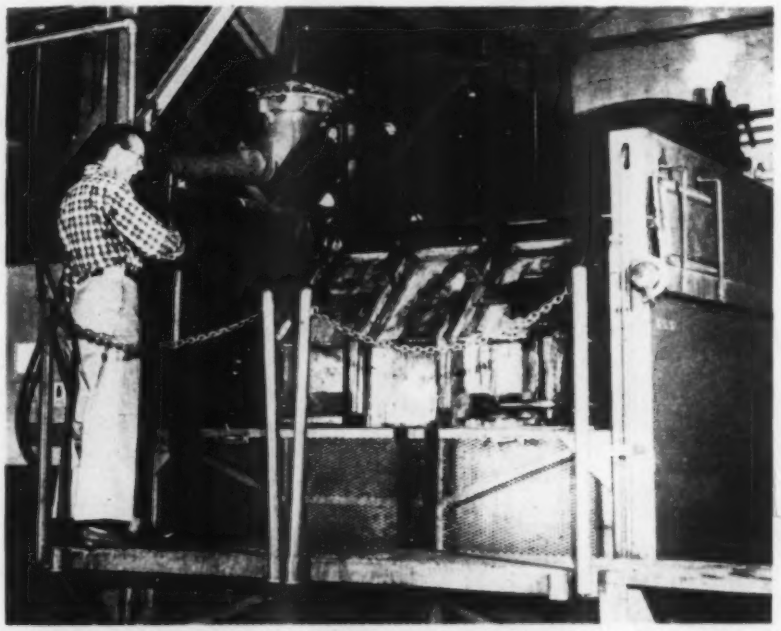
First quarter net earnings equaled $1.10 a share, compared with $4.45 per share for the entire 1956 fiscal year.

Induction Motor

An improved earnings pictures for Induction Motors Corp., of Westburn, L. I., in the fiscal year ending February 28 was forecast by Charles Wohlstetter, chairman of the board.

Wohlstetter said, "Earnings for the year to date are running well ahead of last year. Backlog is the highest in com-pany history $1.8 million, compared with $.9 million for the same period last year. Sales for the entire fiscal year should exceed $2 million, as against $1.7 million a year ago."

David Menkin, executive vice presi-dent of PSP Engineering and Manu-facturing Company, Los Angeles, was elected a member of the Induction board of directors. Menkin has di-rected operations of PSP since that company was acquired by Induction last year.



SOLAR'S $50,000 TUMBLING MACHINE which speeds deburring of stainless steel J57 vane and shroud assemblies 75% over previously used hand method.

Tumbling Machine Ups Production

A specially designed and built tum-bling machine which smooths the edges of complex stainless steel precision jet engine assemblies 75% faster than pre-viously-used methods, has been put into operation by Solar Aircraft Co.

The new machine speeds production by completely eliminating the debur-ring, vapor blast and washing operations, according to the company. Added ad-vantages derived from the machine's use are: less probability of damage to pre-cision parts; better mating of parts in the completed engine; better balanced components; and increased parts life.

The tumbling machine has a rotary drum six feet long and four feet in diameter which can hold up to 14 Solar-built vane and shroud assemblies for the Pratt & Whitney Aircraft J57 turbo-jet engine. These intricate components, which consist of inner and outer shroud rings connected by as many as 160 airfoil vanes, are held rigidly on a cen-tral shaft in the machine while the tumbling barrel rotates slowly about them. A honing and polishing action which smooths and cleans any sharp edges and nicks in the assembly is pro-duced by a mixture of aluminum oxide chips, pieces of mild steel wire and water in the rotating drum. The abrasive charge for each barrel weighs two tons.

The Solar tumbling machine, which cost $50,000, was built by the Almco division, Queen Stove Works, Inc.

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Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

BUREAU OF AERONAUTICS, Washington 25, D. C.

Federal Electric Corp., 100 Kingsland Rd., Clifton, N. J., field engineering services in assembly, alteration, repair, installation or operation of aircraft electrical and electronic equipment, (NOas 57-246-s(MA-30-3735-57), $80,092.

Goodyear Aircraft Corp., Akron 15, Ohio, conduct a research and development program to obtain a light weight, high strength airship ballonet fabric for ZPG-2 type airship, (NOas 57-287-c(AE-52-1829-57), $38,-150.

Bendix Aviation Corp., (Pioneer Central Div.), Davenport, Iowa, instructions to Naval and Marine Corps personnel in the operation, maintenance repair and calibration of the components used in aircraft breathing oxygen systems and allied support equipment, (NOas 57-167-s(MA-30-3717-57), $26,991.

Loral Electronics Corp., 791 E. 140th St., N. Y. 54, N. Y., technically trained employees to provide technical assistance and instruction in the maintenance, repairs and operation of aircraft, electric and electronic equipment, (NOas 57-248-s(MA-30-3745-57), $77,500.

Stavid Engineering, Inc., U. S. Highway 22, Plainfield, N. J., technical trained employees to provide technical assistance and instructions in the maintenance repairs and operation of aircraft electrical and electronic equipment, (NOas 57-250-s(MA-30-3755-57), $75,356.

Brubaker Electronics, Inc., 9151 Exposition Drive, Los Angeles 34, Calif., rotary switch-assembly field change kit, (NOas 57-137-f(PD-31-863-57), $40,660.

Radio Co., 8000 Woodley Ave., Van Nuys, Calif., test and installation of the AN/USQ-10 tracking equipment, KD2-125 targets and ground equipment, (NOas 57-208-c(GM 62-3632-56), $154,112.

The Emerson Electric Mfg. Co., 8100 Florissant Ave., St. Louis 21, Mo., deck turrets 11A, (NOas 57-325r(PD 43-1371-56), $2,901,078.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices:

ROME AF DEPOT, Griffiss AFB, New York.

The Haloid Co., 2-20 Haloid St., Rochester, N. Y., photographic paper, 10 inches x 20 inches, projection type, 10 packages; photographic paper, 20 inches x 24 inches, contrast No. 2, 15 packages; photographic paper, 8 inches x 300 ft., contrast No. 3, 50 roll, (IFB 30-635-57-88B), $180,020.

The Steelcraft Mfg. Co., 9017 Blue Ash Road, Rossmoyne, Ohio, tower AB-258, FPS-6, supports antenna FPS-6, (IFB 30-635-57-31B), 63 ea., $672,021.

Joslyn Mfg. & Supply Co., 155 N. Wacker Dr., Chicago 6, Ill., arrestor, type MX-1528/U, (RFP 30-635-57-4126Q), 50 ea., $26,500.

Mink-Dayton, Inc., 117 N. Findlay St., Dayton 3, Ohio, rack, relay MT-686/GR, (IFB 30-635-57-60B), 1858 ea., $209,563.

Federal Television Corp., 19-10 23rd Terr., Long Island City 5, N. Y., interconnecting CP OA-447(), FSA-4, (RFP 30-635-57-5000Q), 92 ea., $93,264.

John R. Hollingsworth Corp., Sycamore & Mills Rds., Clifton Heights, Pa., distribution panel J-390/GR, (IFB 30-635-57-18B), 1858 ea., $48,791.

General Electric Co., Electronics Park,

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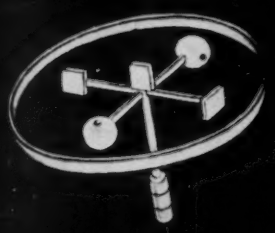

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American Bosch Arma Corporation.

ARMA

Syracuse, N. Y., world-wide contractual depot level maintenance and supply support of radar sets AN/CPS-6B, AN/FPS-6,-7,-8,-10, AN/GPS-3, AN/GPA-72, AN/MPS-11,-14, IF and video mapping equipment, and other specialized back-up equipments. (IRFP 30-635-57-1052Q). $5,518,962.

BASE PROCUREMENT OFFICE, 5th Air Base Group, Travis AFB, Calif.

Delta Construction Co., P. O. Box 457, Rio Vista, Calif., repair of parking areas for aircraft refueling units, project SAC Travis 7-57, (IFB 04-626-57-211, job, $15,-906.

Krull & Krull, 68 Greenfield Ave., Vallejo, Calif., modification of sixty bachelor officers quarters, project SAC Travis 12-57, (IFB 04-626-57-34), job, $21,536.

A. C. Saraiva, 321 Central Ave., Vallejo, Calif., repainting of base facilities, project SAC Travis, 45-57, (IFB 04-626-57-13), job, $56,929.

Vallejo Iron Works, P. O. Box 1000, Vallejo, Calif., modification of alert hangar doors, project SAC Travis 85-57, (IFB 04-626-57-45), job, $19,752.

E. T. Schrock, P. O. Box 269, Vacaville, Calif., modification of building T-195, project SAC Travis 57-56, (IFB 04-626-57-48), job, $16,163.

BASE PROCUREMENT OFFICE, Elmendorf AFB, Anchorage, Alaska.

The Admiral Corp., 3800 Cortland St., Chicago, Ill., refrigerators, 1AAA-742097, 502 ea., (IFB 65-501-57-1201, $47,414.

HEADQUARTERS SACRAMENTO AMA, McClellan AFB, Calif.

Whirlpool Seeger Corp., St. Paul, Minn., pin assy., 879 ea.; valve assy., 335 ea.; valve assy., 329 ea.; (IFB 715, 7150, 71594), $70,624.

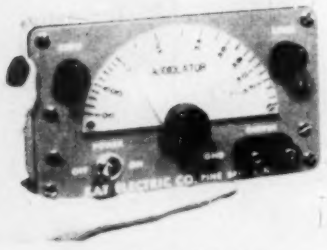
Snap-On Tools Corp., 2605 Market St., Oakland, Calif., cabinets, tool, steel, portable, with bench type top, 190 ea., (IFB 5641), $26,854.

Joy Manufacturing Company, Michigan City, Ind., compressor assy., 44 ea., valve assy., X211562-1-6602, 11 ea.; intercooler assy., X211511-6602, 11 ea., (IFB 2411), $190,389.

OKLAHOMA CITY AMA, Tinker AFB, Okla.

The Train Co., La Crosse, Wis., intercooler assy., turbo air, (IRFP-021-2-005-58698Z4, 1 item, $71,250.

Lockheed Aircraft Corp., Georgia Divi-



Audio-Oscillator

Transistorized beat frequency audio oscillator, Catalog 1,000, powered by mercury or penlight batteries, covers range of 50 to 15,000 cps. in single sweep of dial. An incremental frequency dial permits zero beat adjustment and fine frequency control over entire range. Output voltage is 1 v. at 600 ohms, flat within 1 db. over entire range. Attenuator is continuously variable.

Unit measures 6 x 2 x 3¼ in. Kay Electric Co., 14 Maple Ave., Pine Brook, N. J.

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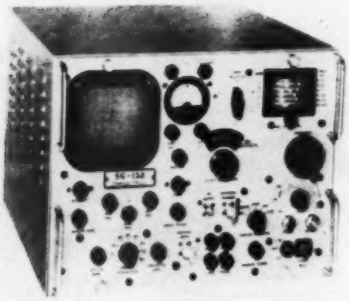

Generator

VHF-UHF SWEEP GENERATOR, Model SG-132, combines features of CW and AM signal generator and a wide band sweep generator. Sweep width is 40% of center frequency, from 15 to 400 mc., with dial accuracy of 0.01%, crystal corrected. Output, entirely fundamental and not from beat-frequency oscillator, is calibrated from 0.1 to 150,000 microvolts throughout frequency range and varies less than 0.2 db. over this range. Instrument has built-in d.c. coupled oscilloscope. Transitron, Inc., 186 Granite St., Manchester, N. H.

sion, Marietta, Ga., fabrication of miscellaneous B-47 modification kits and spare parts. (OC-732655, OC-732655-CTI, job, $8,000,000.

Douglas Aircraft Co., Inc., Tulsa Div., Tulsa, Okla., fabrication of miscellaneous B-47 type kits and spare parts. (OC-706455 and OC-732637), $5,800,000.

PURCHASING AND CONTRACTING OFFICE, Lowry AFB, Colo.

Star Bakery, Denver, Colo., bread, white, rye, raisin, vienna, hard rolls. (IFB 05-606-57-17), various quantities, Est. $48,500.

RCA Service Co. Inc., Camden 2, N. J., factory training, field and organizational level maintenance on M6-10 fire control system, (negotiated), training 224 Air Force personnel, $142,989.

MOBILE AMA, Brookley AFB, Ala.

Bendix Aviation Corp., Utica Div., Utica, N. Y., repair and modification of 36E22 starters. (AF 01(601)20210 letter contract), $153,000.

Bendix Aviation Corp., Utica Div., Utica, N. Y., repair and modification of Bendix 36E26 starters. (AF 01(601)20141 letter contract), $140,000.

Scott Aviation Corp., 207 Erie St., Lancaster, N. Y., 19 items of maintenance and overhaul parts for type A13, A15, and A21 regulators manufactured by Scott Avn. Corp., (RFP 01-601-57-1070, Class 03K), $55,617.

The Aro Equipment Corp., Enterprise & Trevitt Sts., Bryan, Ohio, gage-liquid oxygen contents, 5 liter in accordance with spec MIL-G-008266B (USAF), S/N (AF 5342-2424-526-A2), gage liquid quantity oxygen, 8 liter, 300 PSI converter, IAW spec MIL-G-8283C (ASG), S/N AF 5342-2426-56A-A3), valve oxygen pressure build-up and vent IAW spec MIL-V-8057B (ASG) S/N (AF 5342-FH2B2), (IFB 01-601-57-202, Class 03K), $176,339.

The B. F. Goodrich Co., B. F. Goodrich Avn. Products Div., Akron, Ohio, aircraft fuel cells applicable to the F84E, RF84F and RF84K aircraft, 24 items. (AF 01(601)-20044, Class 01X), $984,851.

The Goodyear Tire & Rubber Co., Inc., Akron, Ohio, aircraft fuel cells applicable to the F84E aircraft, 15 items, (AF 01(601)-20045, Class 01X), $912,081.

The Aro Equipment Corp., Enterprise &

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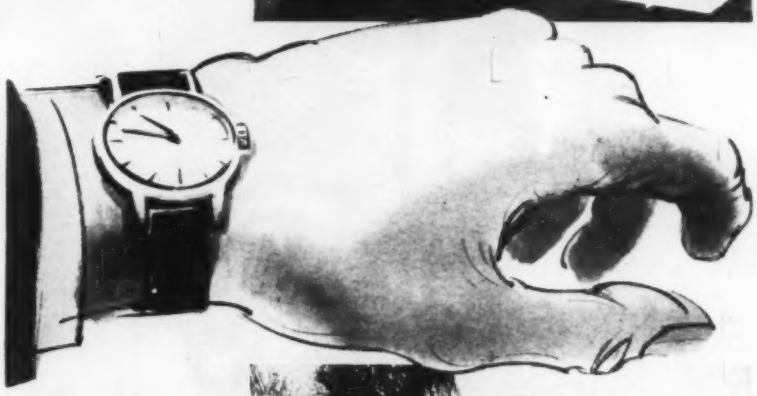

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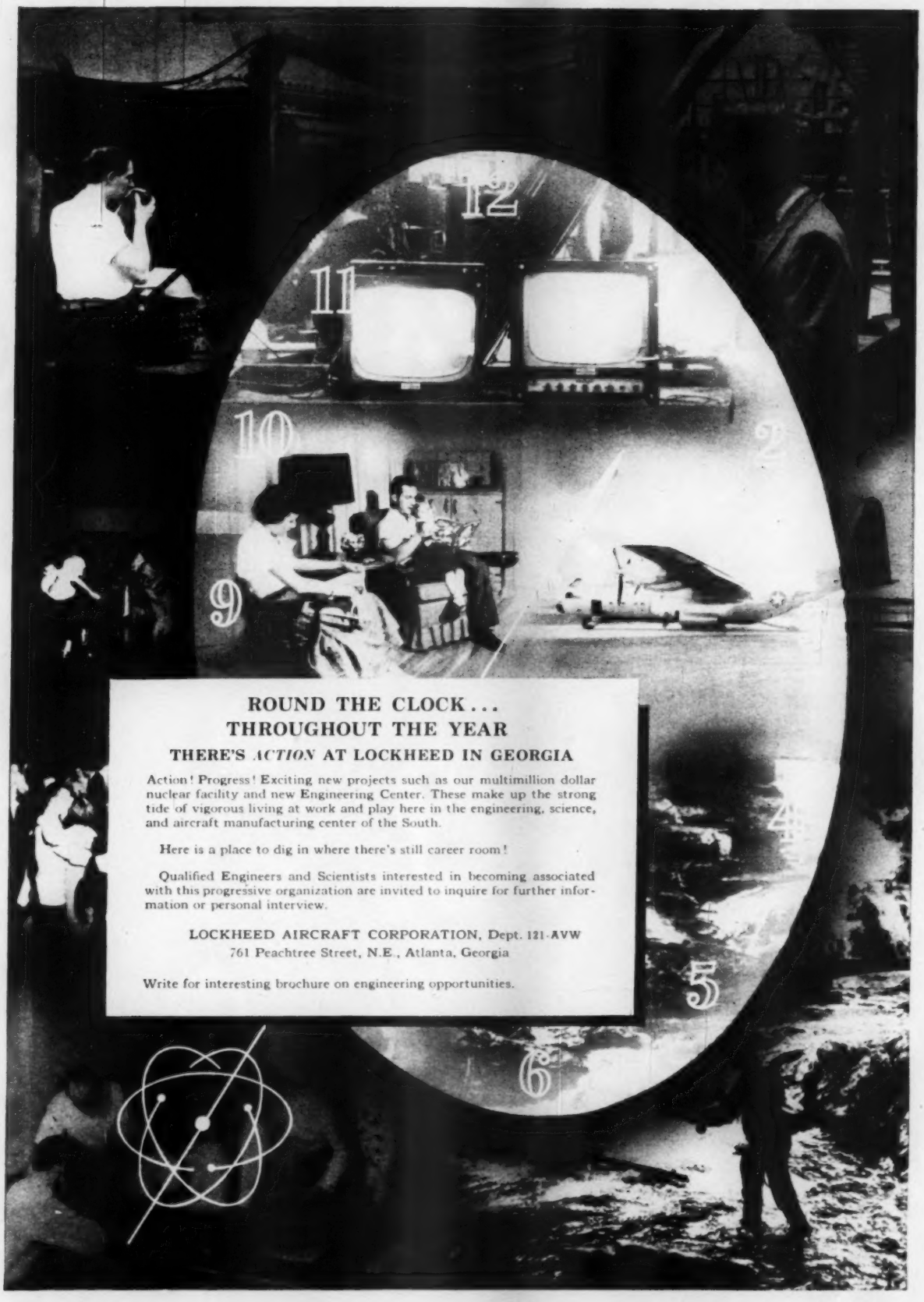

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Transit Sts., Bryan, Ohio, 7 items of maintenance and overhaul parts for type D-2 regulator P/N 5547-17550, (RFP 01-601-57-1075, Class 03K), $73,500.

Sierra Eng. Co., R. A. Hawks Div., 123 E. Montecito Ave., Sierra Madre, Calif., valve, oxygen mask exhalation pressure compensating 1.50 in. H 1.50 in anod finish IAW Spec MIL-V-25126 USAF S/N (AF 509-AAF7112001, 11000 ea. Valve pressure breathing mask flapper rubber 1.187 in. diameter, .702 in. thick, IAW Dwg 41A22194 component of 41A24625 valve, appl. type A-13A and MS22001 oxygen masks, 22000 ea., (RFP 01-601-57-201, Class 03K), $34,980.

The Aro Equipment Corp., Enterprise & Trevitt Sts., Bryan, Ohio, 33 items of maintenance and overhaul parts for type D-2 Regulator P/N 5542-2881-50-A1 Mfg. by Pioneer Central Div. of Bendix Avn. Corp., Davenport, Iowa and 5557-17550 Mfg. by Aro Equipment Corp., Bryan, Ohio, (RFP01-601-57-1076), Class 03K), $88,742.

Bendix Avn. Corp., Pioneer-Central Div., 2734 Hickory Grove Rd., Davenport, Iowa, 33 items of maintenance and overhaul parts for type D-2 regulator P/N 5542-2881-50-A1 mfg. by Pioneer Central Div. of Bendix Avn. Corp., Davenport, Iowa and 5557-17550 mfg. by Aro Equipment Corp., Bryan, Ohio, (RFP 01-601-57-1076, Class 03K), $27,175.

DAYTON AF DEPOT, Gentile AF Station, Dayton 10, Ohio.

Gibbs Mfg. & Research Corp., 150 N. Main St., Jamesville, Wis., signal generator SG-126/U in a/w exhibit RADC 2488 dtd 27 Feb 1956 and as amended by exhibit I attached hereto and made a part hereof and USAF spec bulletin No. 98, 46 ea., maintenance data in a/w MDMTT exhibit 1-16, engrg data in a/w table 250 (PR - MD 6889731), $43,745.

AEMCO, Inc., 10 State St., Mankato, Minn., relay, subminiature, hermetically sealed contractor's P/N R95-2519, 28V DC (PR 7418891), 11900 ea., $79,527.

General Electric Co., Lamp Div., 225 N. Wilkinson St., Dayton, Ohio, lamp-incandescent P/N AN3140-327 (FSS-GL-008-3748), 60000 ea., $191,400.

Telectro Industries Corp., 35-16 37th St., Long Island City 1, N. Y., generator-signal, SG-1A/ARN in a/w military specification MIL-S-4296A (USAF) 287-ca, photographs for above, 2 ea., (RFP 33-604-57-17481), $259,321.

Cutler-Hammer, Inc., 110 W. First St., Dayton 2, Ohio, relay-solenoid non pile-up type DPST in a/w spec MIL-R-6106 (ER ASC) and amend nr 2 dtd 27 June 1956 and dwg AM-27 714-188 ea., Relay-Solenoid, Contact data, non pile-up type 2 DPDT in a/w spec MIL-R-6106 (ER ASC) and amend No. 2 dtd 27 June AN dwg AN 3240-2 (RFB 33-604-57-89), 150 ea., $29,111.

Sonotone Corp., Elmsford, N. Y., tube-electron receiving triode type MH, 6414WA a/w spec MIL-E-10 dtd 2 Oct. 55 (RFB 33-604-57-1521), 212000 ea., $230,080.

General Electric Co., Owensboro, Ky., tube-electron receiving miniature pentagrid JAN type 5750 (ER2W spec MIL-E-10 dtd 2 Oct 55 supplement No. 11 thereto dtd 14 May 56. Individual spec sheet MIL-E-1-9 dtd 12 Jan 53, (RFP 33-604-57-1434), $123,616.

General Electric Co., Syracuse, N. Y., tube-electron, cathode ray type 5SEP1A a/w spec MIL-E-10 dtd 2 Oct. 55, Suppl Nr 1 thereto dtd 25 July 56 and 188 MIL-E 1-48 dtd 5 August 1955 (RFP 33-604-57-1588), $63,385.

Stelma, Inc., 190 Henry St., Stamford, Conn., telegraph distortion analyzer-Stelma Inc., Model TDA-2 and data, (RFP-33-604-57-17491, 74 ea., $20,939.

Aircraft Radio Corp., Boonton, N. J., antenna kit C-0 aircraft Radio Corp P/N 122962-EP-0 ARC type 12, 260 ea., receiver-subassy-aircraft Radio P/N 12031 P/O Aircraft Radio type R-11-AX, 48 ea., plate-set-identification, Aircraft Radio 12034-HR 100 set, relay assy-ARC type K-12-4W Dwg 14063-4WeARC Radio set type used on YT34 ACFT, 146 ea., Gear assy-aircraft radio 14073, 150 ea., spring-bellcrank-Aircraft Radio P/N 12413, 1000 ea., maintenance parts kit-Aircraft Radio Corp Dwg 13049, 55 ea., maintenance parts Kit-Aircraft Radio Corp Dwg 13978, 100 dynamotor DAA-187 ARC P/N 14461 type D-16A-P-0 ARC type 12 and T-36, 100 ea., (RFP 33-604-57-1519).

Chicago Magnetic Control, 1616 N. Damen Ave., Chicago 47, Ill., filter assembly electrical P/O AN ARN-18 receiving set, (RFP 33-604-57-1588), 1500 ea., $51,750.

TOPEKA AF DEPOT, Topeka AF Station, Topeka, Kans.

U. S. Industrial Chemical Co., A Div. of Nat'l Distillers Products Corp., 99 Park Ave., N. Y. 16, N. Y., alcohol-denatured ethyl, (IFB 14-604-56-2861, 19995 gal., $26,097.

Carbide & Carbon Chemicals Co., A Div. of Union Carbide & Carbon Corp., 30 E. 42nd St., N. Y. 17, N. Y., alcohol-denatured ethyl, (IFB 14-604-56-2861, 59990 gal., $31,281.

Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J., nut, (IFB 14-604-57-1811, 540000 ea., $55,292.

The Deutsch Co., 7000 Avalon Blvd., Los Angeles 3, Calif., nut, (IFB 14-604-57-1814, 875000 ea., $75,029.

Carbide & Carbon Chemicals Co., A Div. of Union Carbide & Carbon Corp., 30 E. 42nd St., N. Y. 17, N. Y., deicing-detrosting fluid, (IFB 14-604-57-603, 11261 gal., $14,466.

Ellwood Ivins Steel Tube Works, Inc., Valley Rd. & Coventry Ave., Oak Lane, Philadelphia 26, Pa., steel tubing, (IFB 14-604-57-3561, 03708 ft., $80,792.

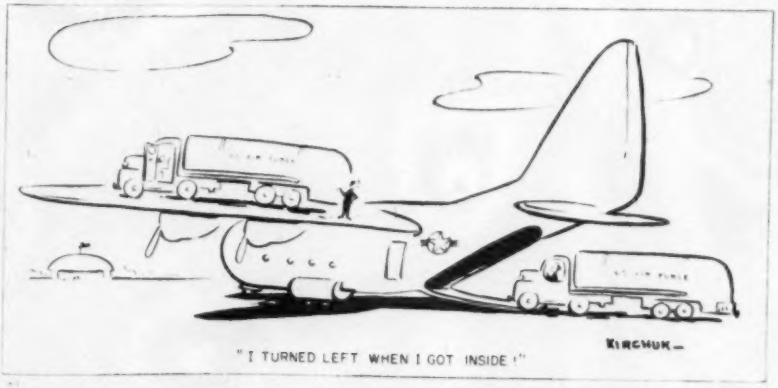
Briles Mfg., 1110 E. Grand Ave., El Segundo, Calif., bolts, (IFB 14-604-57-1834), 42500 ea., $14,829.

Stratoflex, Inc., P. O. Box 18238, Ft. Worth, Tex., fitting end, (IFB 14-604-57-3561, 7000 ea., $57,932.

Delco Chemicals, Inc., 2700 S. Eastern Ave., Los Angeles 22, Calif., cleaning compound, (IFB 14-604-57-2124, 13950 lbs., $12,847.

Sud-Est Producing S-58

S-58, now being produced by Sud-Est Aviation under manufacturing license agreement with Sikorsky Aircraft Division of United Aircraft Corp., is twelve-passenger helicopter powered by a single Lycoming-built Wright R-1820. Decision by French firm followed a series of tests in mountainous regions of Algiers, where aircraft are being used by French armed forces. Westland Aircraft of Great Britain also is producing the S-58. Helicopter has been in quantity production both for the U. S. Navy and U. S. Army since 1954. French have on order 135 Sikorsky helicopters, of which 73 are S-58s, 62 eight-passenger S-55s. They also purchased Sabena's fleet of six S-55s, now being replaced by S-58s, and have ordered 35 S-55s from Westland Aircraft.



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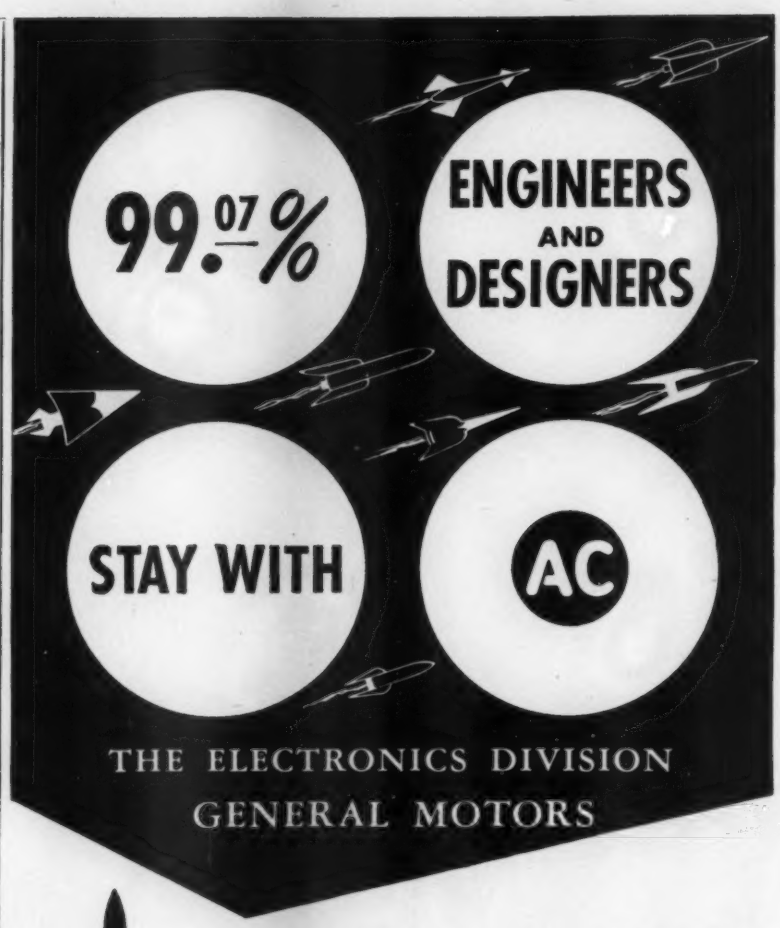

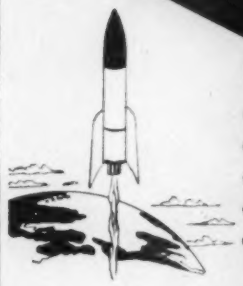

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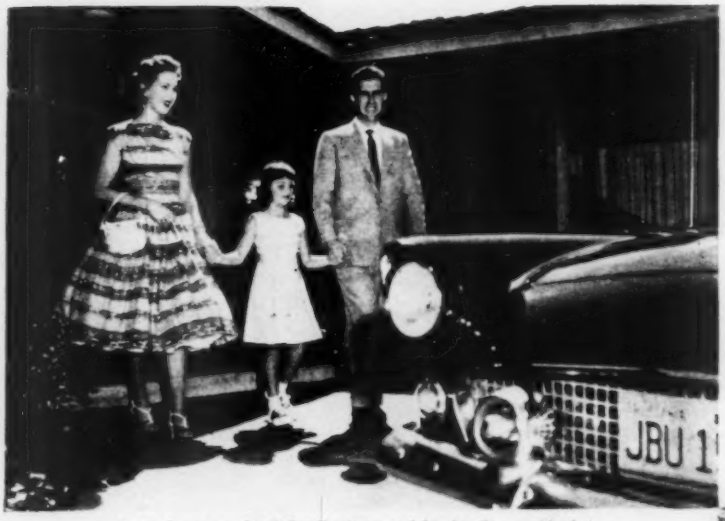

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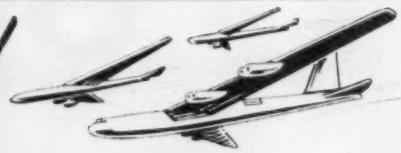

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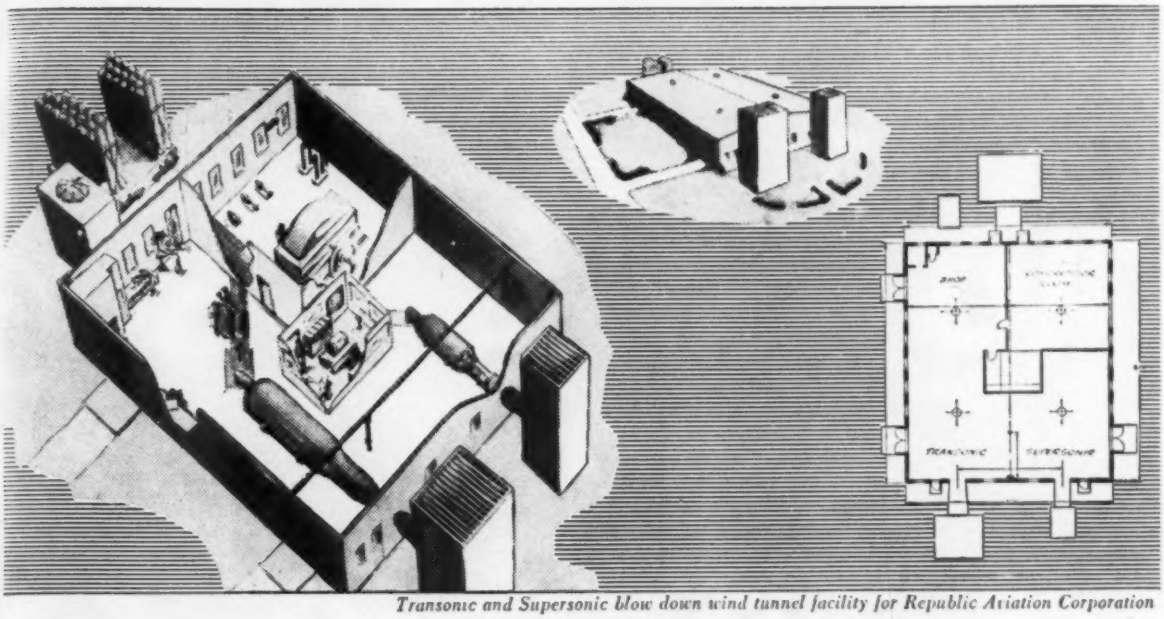

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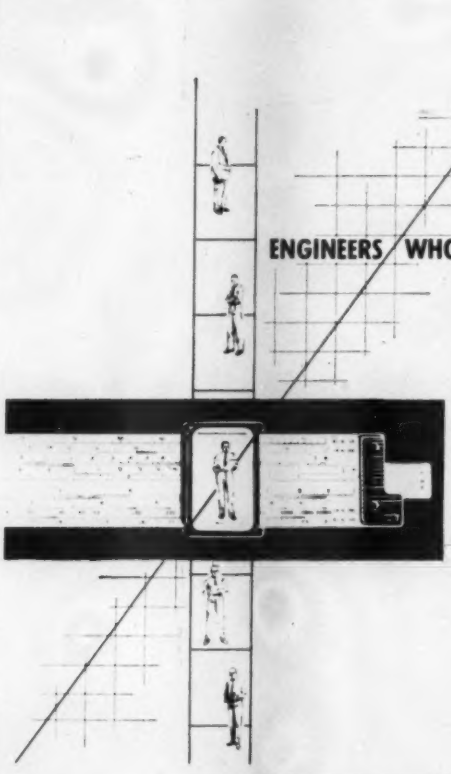

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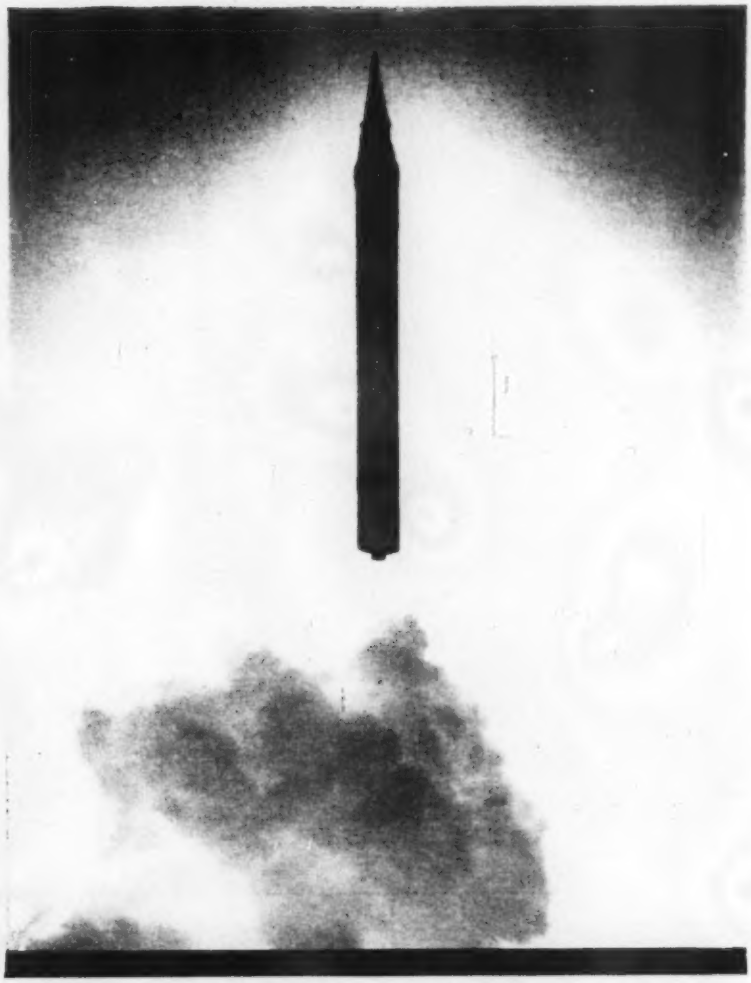

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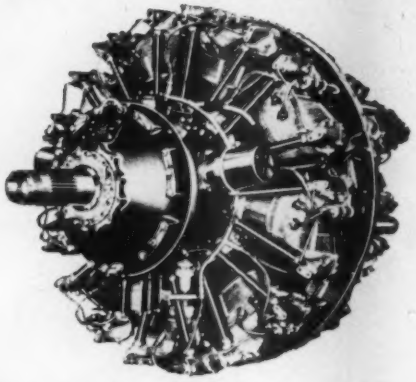

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LETTERS

Nuclear Facts-of-Life

I read your editorial "Nuclear Subs Rattling" in the Dec. 3 issue of AVIATION WEEK and you couldn't have stated the situation more clearly. You are also absolutely right about the need of informing the European man-of-the-street of the facts of life in regard to Russian atomic guided missile capabilities.

For this reason I suggested the Hon. F. A. DiBella, president of the newly formed Centro Aeronautico e Atomico Italian (Italian Aeronautical & Atomic Center), give your article wide diffusion among Italian aeronautical circles and he agreed to do it.

I take the opportunity to tell you my personal admiration for the wonderful job your magazine is performing and I wish you and AVIATION WEEK a very happy and lucky 1957.

COL. FRANCO FIORIO
Rome, Italy

Airlift Lesson

During the month of November (AW Nov. 19) you wrote an excellent editorial on the Suez issue—how the lack of adequate airlift hampered the operation for the British and the French forces, and that if adequate airlift had been available, events might have taken an entirely different turn.

I thought this one of the best articles written on the airlift question, and would very much appreciate it if you could arrange to send me about three copies.

D. W. RENTZEL
Chairman of the Board
Slick Airways, Inc.
Oklahoma City, Okla.

Visibility

Your issue of Oct. 8 includes a letter from W. H. Becker proposing "better visibility in the airliner cockpit" as a solution to the midair collision problem. In support of his proposal, the writer states that "rate of closure had nothing to do with the Arizona accident" and that "given the visibility of a Bonanza, that accident would not have occurred."

I suppose no one will deny the desirability of better cockpit visibility—certainly I do not. Nevertheless, I feel that the question of the roles of both closure rate and visibility limitations in the UAL-TWA collision should be given another look.

As I understand it, the evidence shows that for some minutes prior to collision, both aircraft were in level flight, at the same altitude, in normal cruise condition, that barring possible last minute evasive action neither craft maneuvered during this period, that most probable airspeeds were about 270 kt., 288 kt. respectively, and most probable heading difference was about 20°.

Application of simple trigonometry to these figures gives the following results:

1) *Closure rate* was 981½ kt., or five and one-half times the airspeed difference.

2) *Bearing* of the slower craft as seen from the faster was 69½ deg. from dead ahead.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

3) *Bearing* of the faster as seen from the slower was 90½ deg.

Of course, airspeeds and headings are not precisely known; perhaps heading difference is the more uncertain. If the stated airspeeds are accepted:

4) *Bearing* of the slower craft from the faster could not be more than 70 deg. for any heading difference;

5) *For heading* difference of 10 deg., bearing of the faster aircraft from the slower is 105 deg. As heading difference increases to 40 deg., this bearing decreases to 74 deg.

For any reasonably probable combination of airspeeds:

6) *Closure rate* is about 50 kt. for heading difference of 10 deg., 100 knots for 20 deg., and 145 knots for 30 deg.

Closure rate is near the airspeed difference only if the heading difference is very small—less than 5 deg. In this case the faster craft would be out of sight from the cockpit of the slower. But the slower would be nearly dead ahead of the faster, at short range, for several minutes.

J. S. MORRELL
Ruxton, Md.

Cockpit Controversy

Surely Capt. "Ace" Robson's comments on "The Jet Crew" (Cockpit Viewpoint, AW Dec. 24) are not to be taken as a truly objective and impartial analysis of future jet crew needs? "Ace," who is the pilot union chairman in Washington, D. C., has merely espoused the ALPA (Clarence Sayen) philosophy of the three man pilot crew in order to make his own job secure in the coming airline jet era. This type of union propaganda should be restricted from a magazine such as AVIATION WEEK.

To clear the Clarence Sayen smoke screen, I refer you to page 22, item 2 of the "American Air Line Jet Study Committee Report," organized by ALPA, with Mr. R. Lewis as its chairman. The study says, "There will be considerable technological unemployment on American airlines by 1961. Estimates of pilot needs range from 873 to 1,286 (present number of pilots 1,650)... Even a reduction of flying hours to 65 hours per month will not alleviate this problem." Anyone can see why ALPA now wants a three pilot crew. Clarence Sayen seems more concerned about maintaining his union empire than he does about harmonious cockpit relations between pilots and flight engineers.

I don't think that "Ace" really believes the airframe manufacturers sales promotion program about "lack of jet complexity." If this spurious philosophy is true, then for the first time in half a century the state of the art has reversed itself.

If the CAB can be persuaded by Sayen's sophistry to lower the requirements for flight engineer qualification, then once again better public policy will have been ignored completely. It seems to me that when the pilots and the flying public go aloft in these $3 $5 million pieces of "simplicity," they would prefer the third man to be a technician rather than a tire kicker.

As a long time subscriber, I request that you publish this letter in order to separate the chaff from the seed for your readers. (If you will do this, then perhaps your readers can properly weigh the true values involved in this controversy.

JAMES T. PETTIT
Flight Engineer
Pacoima, Calif.

Ruffled

I have witnessed the ambiguous controversy over Copilot vs. Engineer for some weeks and very seldom get ruffled enough to write a letter of this type. Now it seems that I have.

First, there have been too many comments from the engineer toward the degradation and usurpation of the importance of the lowly copilot. Now for a few facts, not fiction. I am one of the copilots. I cannot see how we became involved in this argument, but since we are, let's list a few of the qualifications which I personally had when I became a copilot.

I was an aircraft mechanic for three years in the Air Force, having completed the A&E school. I was a Maintenance and Flight Test Officer for four years, and Supervisor of Inspection for Maintenance in the Air Force for two years. I have an E rating from the CAA and I can do any work on an aircraft that any engineer can perform, and I venture to say that it will not be rejected by an inspector. I began flying in 1940 and have been at it steadily since. I have logged (not by Parker 51 either) 7,000 hours in everything from Cubs to jets inclusive. I hold a CAA control tower operators permit, an airline transport certificate, an instructor's ticket, and last but not least, an engineer's (Flight) certificate. I have, so to speak, lived with and for aircraft since I can remember. This is one qualification which a lot of flight engineers do not have.

If there is a flight engineer around who has a longer background of continued study in aircraft and who says that a copilot does not have to have any required qualifications, let him be heard. Personally, I feel there should be no friction between crew members, but some has been injected into it by this continued harangue. I, for one, am for forgetting the whole thing since each crew member has his assigned place in the aircraft and to read from the manuals, "The First Officer is second in command."

Were we not qualified that sentence would not be there, and I surely would hate to be out in the black of night in some of the congested areas that exist today and have to have a flight engineer get me down safely. So therein lies the crux of the matter. The flight engineer should work his position and the rest of the crew do the same.

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Fort Worth, Tex.

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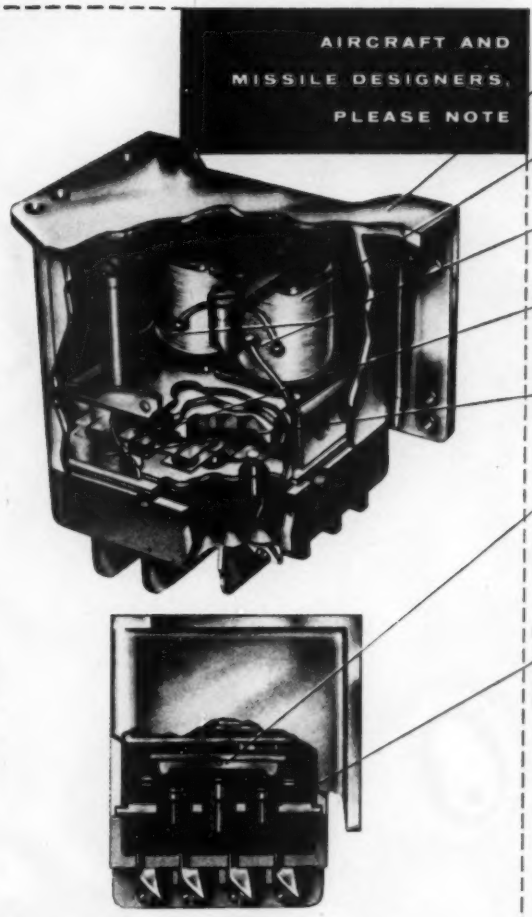

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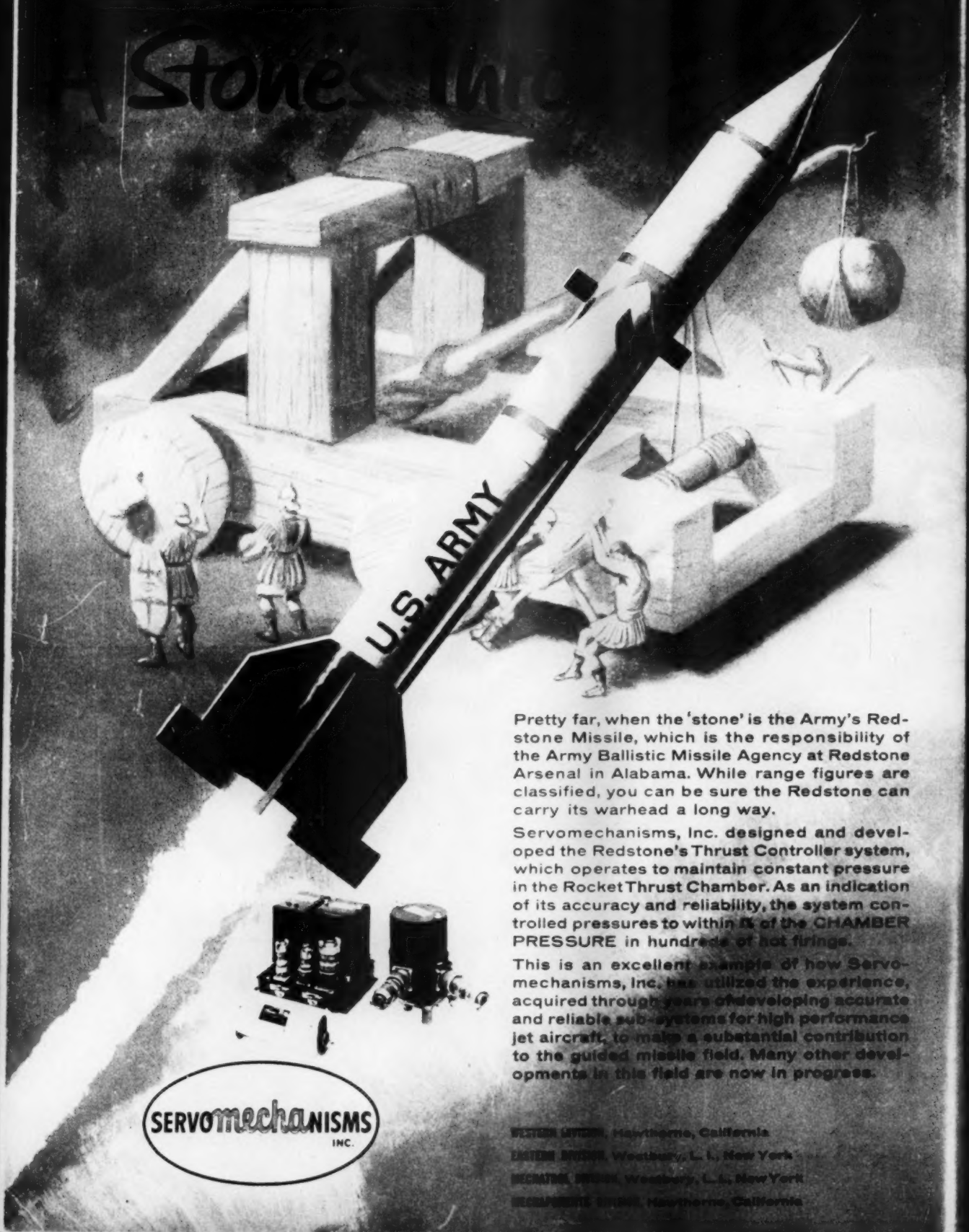

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